SOFTWARE RELEASE NOTICE

1. SRN Number: 256

2. Project Title: Thermal Effects on Flow	Project No. 20.01402.661
3. SRN Title: AMESH 2.0	
4. Originator/Requestor: Cynthia L. Dinwiddie	Date: October 19, 2001

5. Summary of Actions

- ☒ Release of new software
- ☐ Change of access software
- ☐ Release of modified software:
- ☐ Software Retirement
  - ☐ Enhancements made
  - ☐ Corrections made

6. Validation Status

- ☐ Validated
- ☐ Limited Validation
- ☒ Not Validated — Explain: To be determined

7. Persons Authorized Access

Name	Read Only/Read-Write	Addition/Change/Delete
Scott Painter	Read Only	
Ron Green	Read Only	
Cynthia Dinwiddie	Read Only	

8. Element Manager Approval: [signature] 10/15/01 Date: 10-19-2001

9. Remarks: Likely to also be used for ENFE and USFIC. [signature] 10/15/01

CNWRA Form TOP-6 (09/01)

SOFTWARE SUMMARY FORM

01. Summary Date: 10/19/01	02. Summary prepared by (Name and phone) Cynthia L. Dinwiddie (210) 522-6085	03. Summary Action: New
04. Software Date: 09/27/01	05. Short Title: AMESH	
06. Software Title: AMESH 2.0		07. Internal Software ID: none

08. Software Type: ☐ Automated Data System ☒ Computer Program ☐ Subroutine/Module	09. Processing Mode: ☐ Interactive ☒ Batch ☐ Combination	10. Application Area a. General: ☒ Scientific/Engineering ☐ Auxiliary Analyses ☐ Total System PA ☐ Subsystem PA ☐ Other b. Specific: A mesh-generating program for use with the Integral Finite-Difference Method
11. Submitting Organization and Address: CNWRA/SwRI 6220 Culebra Road San Antonio, TX 78228		12. Technical Contact(s) and Phone: Scott Painter, (210) 522-3348 Ron Green, (210) 522-5305 Cynthia Dinwiddie, (210) 522-6085
13. Software Application: This code is used to create meshes/grids for the Integral Finite-Difference Method		

14. Computer Platform SUN	15. Computer Operating System: Solaris 5.8	16. Programming Language(s): C	17. Number of Source Program Statements: 400
18. Computer Memory Requirements: Problem Dependent	19. Tape Drives: NA	20. Disk Units: NA	21. Graphics: NA
22. Other Operational Requirements			
23. Software Availability: ☒ Available ☐ Limited ☐ In-House ONLY		24. Documentation Availability: ☐ Available ☒ Preliminary ☐ In-House ONLY	
25. Software ~~Developer~~ USER: Charles B. Haukwa Date: 10/30/2001			

CNWRA Form TOP-4-1 (05/98)

Cynthia Dinwiddie 10/23/01

Memorandum

To: Bruce Mabrito

CC: English Pearcy, Scott Painter

From: Cynthia Dinwiddie CD

Date: 10/19/01

Re: AMESH 2.0: Installation & Minimal Acceptance Testing

The not-to-be-modified acquired software AMESH 2.0 (A mesh-creating program for the Integral Finite Difference Method) is to be controlled in accordance with the pertinent provisions of TOP-018. Charles B. Haukwa, of the Earth Sciences Division at Ernest Orlando Lawrence National Laboratory in Berkeley, CA, wrote AMESH 2.0 and the AMESH User's Manual. Installation testing took place on the Sun platform, Solaris 5.8 operating system, and the software was compiled with the Sun Workshop Compiler C 5.0. Minimal Acceptance Testing for TOP-018 control of acquired software, which assures the user that the software operates as intended, was accomplished by running the six (6) test cases provided in the available User's Manual. AMESH 2.0 functioned as anticipated, except for minor discrepancies as noted below, attributable to an out-of-date User's Manual. In other words, the software (AMESH 2.0) operates as expected, and only the documentation is faulty.

An Oversight in Description of CONNE Output

An oversight has been discovered in the available AMESH User's Manual, Section 3.2 (AMESH output), page 14. The uninitiated user is led to believe that the generated 'CONNE' file contains entries for connected element pairs only, rather than for elemental boundaries, as well. Discovery of this oversight occurred when running the simplest test case provided by the code's author. The input for this test case is found on page 16 of the User's Manual, and is Example 3.3.1: Uniform 2D grid spacing in a rectangular domain. The author of the User's Manual provides either in part or in full the three (3) output files, ELEME, CONNE, and SEGMT, generated by running the input file (IN). The author of the User's Manual provides the expected output file ELEME in full, and it is in complete agreement with the ELEME file generated by running AMESH 2.0. The expected output file SEGMT is provided in part, and it is also in complete agreement with the SEGMT file generated when running AMESH 2.0. The expected output file CONNE is *apparently* provided in full by the author, yet it systematically neglects the lines of output pertaining to boundary elements that are generated when running AMESH 2.0. This discrepancy is either an oversight on the part of the author of the User's Manual, or it may be attributable to usage of an out-of-date version of the User's Manual. Please not that this error in the User's Manual doesn't affect the proper functioning of the AMESH 2.0 code.

CENTER FOR NUCLEAR WASTE REGULATORY ANALYSES
QA VERIFICATION REPORT
FOR
→*ACQUIRED SOFTWARE NOT TO BE MODIFIED*←

Software Title/Name:	AMESH
Version:	2.0
Demonstration workstation:	Atlantis 180 / Room A263
Operating System:	Solaris 5.8
User:	Cynthia Dinwiddie

NOTE: Acquired software may or may not meet all requirements and will be evaluated on a case-by-case basis.

Installation Testing [TOP-018, Section 5.6]

Has *installation testing* been conducted for each intended computer platform and operating system?

Yes:■ No:❐ N/A:❐

Computer Platforms: SUN Operating Systems: Solaris 5.8

Location of Acceptance Test Results: QA folder

Comments:

Software Output [TOP-018, Section 5.5.4]

Is software designed so that individual runs are uniquely identified by date, time, name of software and version?

Yes:❐ No:■ N/A:❐

Date and Time Displayed: ___
Name/Version Displayed: ___

Comments: Runs are only identified by the filename

NOTE: Output identification content and format is typically taken as is.

Medium Documentation [TOP-018, Section 5.5.6]

The physical labeling of software medium (tapes, disks, etc.) contains: Program Name, Module/Name/Title, Module Revision, File type (ASCII, OBJ, EXE), Recording Date, and Operating System(s)?

Yes:■ No:❐ N/A:❐

Comments: File type is ASCII

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User Documentation [TOP-018, Section 5.5.7]

Is there a Users' Manual for the software and is it up-to-date?

Yes: ■ No: ❐ N/A: ❐

User's Manual Version and Date: August 31, 1998
Comments:

Are there basic instructions for the *installation* and *use* of the software?

Yes: ■ No: ❐ N/A: ❐

Location of Instructions: QA folder
Comments:

Configuration Control [TOP-018, Section 5.7, 5.9.3]

Is the Software Summary Form (Form TOP-4-1) completed and signed?

Yes: ■ No: ❐ N/A: ❐

Date of Approval: 10/23/2001

Is the list of files attached to the Software Summary Form complete and accurate?

Yes: ■ No: ❐ N/A: ❐

Comments: Files also included on the CD

Is the source code available or, is the executable code available in the case of (acquired/commercial codes)?

Yes: ■ No: ❐ N/A: ❐

Location of Source Code: On the CD
Comments:

Have all the script/make files and executable files been submitted to the Software Custodian?

Yes: ■ No: ❐ N/A: ❐

Location of executable files: On the CD
Comments:

CENTER FOR NUCLEAR WASTE REGULATORY ANALYSES
QA VERIFICATION REPORT
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→ *ACQUIRED SOFTWARE NOT TO BE MODIFIED* ←

Software Release [TOP-018, Section 5.9]

Upon acceptance of the software as verified above, has a Software Release Notice (SRN), Form TOP-6 been issued and does the version number of the software match the documentation?

Yes: ■ No: ❐ N/A: ❐

SRN Number: GHGC-SRN-256
Comments:

Software Validation [TOP-018, Section 5.10]

Has a Software Validation Test Plan (SVTP) been prepared for the ***range of application*** of the software?

Yes: ❐ No: ■ N/A: ❐

Version and Date of SVTP: ---

Date Reviewed and Approved via QAP-002: ---

Comments: To be determined

Has a Software Validation Test Report (SVTR) been prepared that documents the results of the validation cases, interpretation of the results, and determination if the software has been validated?

Yes: ❐ No: ■ N/A: ❐

Version and Date of SVTR: ---

Date Reviewed and Approved via QAP-002: ---

Comments: To be determined

Additional Comments: The primary users are Scott Painter and Ron Green.

Cynthia Dinniddie
Software Evaluator/User/Date 10/23/01

Bruce Mabrito 10/30/2001
Software Custodian/Date

Source code
print out

```
/* Locates input file and calls all associated modules*/

#include    <stdio.h>

struct      locat *locat;
struct      bound *bound;
double      toler = 0.;

void
main()
{
      FILE  *fp;

      if((fp = fopen("in","r")) == NULL) {
            perror("in-open"); exit(1);
      }
      rmesh(fp);
      (void)fclose(fp);
      if(!locat) exit(1);
      extre();
      pmesh();
}
```

```
SSH Secure Shell 2.3 (Build 134)
Copyright (c) 2000 SSH Communications Security Corp - http://www.ssh.com/

This is a commercial version and requires a license from
SSH Communications Security Corp.

This program uses RSA BSAFE® Crypto-C by RSA Security Inc.

Last login: Fri Oct 19 2001 10:43:31 -0600

This is a Center for Nuclear Waste Regulatory Analyses (CNWRA) computer
system and should be used only by authorized persons. This computer system
is monitored and all data/information may be examined, recorded or copied.
You should not expect privacy nor protection of privileged communication
regarding information you create, send, receive, use or store in this
computer system.
Your use of the CNWRA computer system constitutes consent to monitoring.
Unauthorized use is strictly prohibited. (Ref. Administrative Procedure -014)

No mail.

This is a Center for Nuclear Waste Regulatory Analyses (CNWRA) computer
system and should be used only by authorized persons. This computer system
is monitored and all data/information may be examined, recorded or copied.
You should not expect privacy nor protection of privileged communication
regarding information you create, send, receive, use or store in this
computer system.
Your use of the CNWRA computer system constitutes consent to monitoring.
Unauthorized use is strictly prohibited. (Ref. Administrative Procedure -014)

[dinwiddi@spock] /home/dinwiddie {1} % ls
total 30
drwxr-xr-x   6 dinwiddi sunuser      512 Sep 27 10:17 .
drwxr-xr-x 125 1001     root        2560 Oct  4 09:59 ..
-rw-------   1 dinwiddi sunuser       77 Sep 25 16:14 .TTauthority
-rwxr-xr-x   1 dinwiddi sunuser      491 Sep 27 13:58 .cshrc
drwxr-xr-x  11 dinwiddi sunuser      512 Sep 25 16:14 .dt
-rwxr-xr-x   1 dinwiddi sunuser     5111 Sep 25 15:16 .dtprofile
drwx------   2 dinwiddi sunuser      512 Sep 25 16:13 .solregis
drwxr-xr-x   8 dinwiddi sunuser      512 Oct  3 10:40 amesh
drwxr-xr-x   2 dinwiddi sunuser      512 Sep 21 15:22 test2
[dinwiddi@spock] /home/dinwiddie {2} % cd amesh
[dinwiddi@spock] /home/dinwiddie/amesh {3} % ls
total 1550
drwxr-xr-x   8 dinwiddi sunuser      512 Oct  3 10:40 .
drwxr-xr-x   6 dinwiddi sunuser      512 Sep 27 10:17 ..
-rw-r--r--   1 dinwiddi sunuser      165 Sep 27 10:07 Makefile
-rw-r--r--   1 dinwiddi sunuser      313 Sep 27 10:07 amesh.c
-rw-r--r--   1 dinwiddi sunuser      246 Sep 27 10:07 amesh.h
-rwxr-xr-x   1 dinwiddi sunuser   180224 Sep 27 13:42 amesh.spock
drwxr-xr-x   2 dinwiddi sunuser      512 Sep 27 14:50 amesh331
drwxr-xr-x   2 dinwiddi sunuser      512 Sep 27 15:07 amesh332
drwxr-xr-x   2 dinwiddi sunuser      512 Sep 27 15:27 amesh333
drwxr-xr-x   2 dinwiddi sunuser      512 Oct  3 10:40 amesh334
drwxr-xr-x   2 dinwiddi sunuser      512 Sep 27 15:40 amesh335
drwxr-xr-x   2 dinwiddi sunuser      512 Sep 27 16:20 amesh336
-rw-r--r--   1 dinwiddi sunuser   564224 Sep 27 13:43 amesh_v2.doc
-rw-r--r--   1 dinwiddi sunuser     2030 Sep 27 10:07 belem.c
-rw-r--r--   1 dinwiddi sunuser      757 Sep 27 10:07 bstar.c
-rw-r--r--   1 dinwiddi sunuser     1035 Sep 27 10:07 extre.c
-rw-r--r--   1 dinwiddi sunuser     5356 Sep 27 10:07 mflomesh2.c
-rw-r--r--   1 dinwiddi sunuser     2754 Sep 27 10:07 pmesh.c
-rw-r--r--   1 dinwiddi sunuser      357 Sep 27 10:07 readmathout.c
-rw-r--r--   1 dinwiddi sunuser     2110 Sep 27 10:07 rmesh.c
-rw-r--r--   1 dinwiddi sunuser     1325 Sep 27 10:07 xsnodes.c
[dinwiddi@spock] /home/dinwiddie/amesh {4} % ls
total 1552
drwxr-xr-x   8 dinwiddi sunuser      512 Oct 26 13:41 .
drwxr-xr-x   6 dinwiddi sunuser      512 Sep 27 10:17 ..
-rw-r--r--   1 dinwiddi sunuser      165 Sep 27 10:07 Makefile
-rw-r--r--   1 dinwiddi sunuser      313 Sep 27 10:07 amesh.c
```

```
-rw-r--r--   1 dinwiddi sunuser      246 Sep 27 10:07 amesh.h
-rwxr-xr-x   1 dinwiddi sunuser   180224 Sep 27 13:42 amesh.spock
drwxr-xr-x   2 dinwiddi sunuser      512 Sep 27 14:50 amesh331
drwxr-xr-x   2 dinwiddi sunuser      512 Sep 27 15:07 amesh332
drwxr-xr-x   2 dinwiddi sunuser      512 Sep 27 15:27 amesh333
drwxr-xr-x   2 dinwiddi sunuser      512 Oct  3 10:40 amesh334
drwxr-xr-x   2 dinwiddi sunuser      512 Sep 27 15:40 amesh335
drwxr-xr-x   2 dinwiddi sunuser      512 Sep 27 16:20 amesh336
-rw-r--r--   1 dinwiddi sunuser   564224 Sep 27 13:43 amesh_v2.doc
-rw-r--r--   1 dinwiddi sunuser     2030 Sep 27 10:07 belem.c
-rw-r--r--   1 dinwiddi sunuser      757 Sep 27 10:07 bstar.c
-rw-r--r--   1 dinwiddi sunuser     1035 Sep 27 10:07 extre.c
-rw-r--r--   1 dinwiddi sunuser     1019 Sep 27 15:06 in
-rw-r--r--   1 dinwiddi sunuser     5356 Sep 27 10:07 mflomesh2.c
-rw-r--r--   1 dinwiddi sunuser     2754 Sep 27 10:07 pmesh.c
-rw-r--r--   1 dinwiddi sunuser      357 Sep 27 10:07 readmathout.c
-rw-r--r--   1 dinwiddi sunuser     2110 Sep 27 10:07 rmesh.c
-rw-r--r--   1 dinwiddi sunuser     1325 Sep 27 10:07 xsnodes.c
[dinwiddi@spock] /home/dinwiddie/amesh {5} % amesh.spock
[dinwiddi@spock] /home/dinwiddie/amesh {6} % ls
total 1576
drwxr-xr-x   8 dinwiddi sunuser      512 Oct 26 13:41 .
drwxr-xr-x   6 dinwiddi sunuser      512 Sep 27 10:17 ..
-rw-r--r--   1 dinwiddi sunuser      165 Sep 27 10:07 Makefile
-rw-r--r--   1 dinwiddi sunuser      313 Sep 27 10:07 amesh.c
-rw-r--r--   1 dinwiddi sunuser      246 Sep 27 10:07 amesh.h
-rwxr-xr-x   1 dinwiddi sunuser   180224 Sep 27 13:42 amesh.spock
drwxr-xr-x   2 dinwiddi sunuser      512 Sep 27 14:50 amesh331
drwxr-xr-x   2 dinwiddi sunuser      512 Sep 27 15:07 amesh332
drwxr-xr-x   2 dinwiddi sunuser      512 Sep 27 15:27 amesh333
drwxr-xr-x   2 dinwiddi sunuser      512 Oct  3 10:40 amesh334
drwxr-xr-x   2 dinwiddi sunuser      512 Sep 27 15:40 amesh335
drwxr-xr-x   2 dinwiddi sunuser      512 Sep 27 16:20 amesh336
-rw-r--r--   1 dinwiddi sunuser   564224 Sep 27 13:43 amesh_v2.doc
-rw-r--r--   1 dinwiddi sunuser     2030 Sep 27 10:07 belem.c
-rw-r--r--   1 dinwiddi sunuser      757 Sep 27 10:07 bstar.c
-rw-r--r--   1 dinwiddi sunuser     2947 Oct 26 13:41 conne
-rw-r--r--   1 dinwiddi sunuser     1303 Oct 26 13:41 eleme
-rw-r--r--   1 dinwiddi sunuser     1035 Sep 27 10:07 extre.c
-rw-r--r--   1 dinwiddi sunuser     1019 Sep 27 15:06 in
-rw-r--r--   1 dinwiddi sunuser     5356 Sep 27 10:07 mflomesh2.c
-rw-r--r--   1 dinwiddi sunuser     2754 Sep 27 10:07 pmesh.c
-rw-r--r--   1 dinwiddi sunuser      357 Sep 27 10:07 readmathout.c
-rw-r--r--   1 dinwiddi sunuser     2110 Sep 27 10:07 rmesh.c
-rw-r--r--   1 dinwiddi sunuser     6232 Oct 26 13:41 segmt
-rw-r--r--   1 dinwiddi sunuser     1325 Sep 27 10:07 xsnodes.c
[dinwiddi@spock] /home/dinwiddie/amesh {7} % cd amesh 332
cd: Too many arguments
[dinwiddi@spock] /home/dinwiddie/amesh {8} % ls
total 1576
drwxr-xr-x   8 dinwiddi sunuser      512 Oct 26 13:41 .
drwxr-xr-x   6 dinwiddi sunuser      512 Sep 27 10:17 ..
-rw-r--r--   1 dinwiddi sunuser      165 Sep 27 10:07 Makefile
-rw-r--r--   1 dinwiddi sunuser      313 Sep 27 10:07 amesh.c
-rw-r--r--   1 dinwiddi sunuser      246 Sep 27 10:07 amesh.h
-rwxr-xr-x   1 dinwiddi sunuser   180224 Sep 27 13:42 amesh.spock
drwxr-xr-x   2 dinwiddi sunuser      512 Sep 27 14:50 amesh331
drwxr-xr-x   2 dinwiddi sunuser      512 Sep 27 15:07 amesh332
drwxr-xr-x   2 dinwiddi sunuser      512 Sep 27 15:27 amesh333
drwxr-xr-x   2 dinwiddi sunuser      512 Oct  3 10:40 amesh334
drwxr-xr-x   2 dinwiddi sunuser      512 Sep 27 15:40 amesh335
drwxr-xr-x   2 dinwiddi sunuser      512 Sep 27 16:20 amesh336
-rw-r--r--   1 dinwiddi sunuser   564224 Sep 27 13:43 amesh_v2.doc
-rw-r--r--   1 dinwiddi sunuser     2030 Sep 27 10:07 belem.c
-rw-r--r--   1 dinwiddi sunuser      757 Sep 27 10:07 bstar.c
-rw-r--r--   1 dinwiddi sunuser     2947 Oct 26 13:41 conne
-rw-r--r--   1 dinwiddi sunuser     1303 Oct 26 13:41 eleme
-rw-r--r--   1 dinwiddi sunuser     1035 Sep 27 10:07 extre.c
-rw-r--r--   1 dinwiddi sunuser     1019 Sep 27 15:06 in
-rw-r--r--   1 dinwiddi sunuser     5356 Sep 27 10:07 mflomesh2.c
-rw-r--r--   1 dinwiddi sunuser     2754 Sep 27 10:07 pmesh.c
```

```
-rw-r--r--   1 dinwiddi sunuser      357 Sep 27 10:07 readmathout.c
-rw-r--r--   1 dinwiddi sunuser     2110 Sep 27 10:07 rmesh.c
-rw-r--r--   1 dinwiddi sunuser     6232 Oct 26 13:41 segmt
-rw-r--r--   1 dinwiddi sunuser     1325 Sep 27 10:07 xsnodes.c
[dinwiddi@spock] /home/dinwiddie/amesh {9} % cd amesh332
[dinwiddi@spock] /home/dinwiddie/amesh/amesh332 {10} % ls
total 30
drwxr-xr-x   2 dinwiddi sunuser      512 Sep 27 15:07 .
drwxr-xr-x   8 dinwiddi sunuser      512 Oct 26 13:41 ..
-rw-r--r--   1 dinwiddi sunuser     2947 Sep 27 15:06 conne
-rw-r--r--   1 dinwiddi sunuser     1303 Sep 27 15:06 eleme
-rw-r--r--   1 dinwiddi sunuser     1019 Sep 27 15:06 in
-rw-r--r--   1 dinwiddi sunuser     6232 Sep 27 15:07 segmt
[dinwiddi@spock] /home/dinwiddie/amesh/amesh332 {11} %
```

SOFTWARE VALIDATION REPORT FOR AMESH VERSION 2.0

Prepared for

U.S. Nuclear Regulatory Commission
Contract NRC–02–02–012

Prepared by

Cynthia L. Dinwiddie

Center for Nuclear Waste Regulatory Analyses
San Antonio, Texas

April 2003

ABSTRACT

AMESH is a computer code for generating Voronoi tessellations, which may be used as unstructured integral finite-difference grids in coupled thermal-hydrological-chemical process models. This software may be used in reviewing the license application for the high-level waste repository proposed for Yucca Mountain, Nevada. Six software validation tests were conducted to determine that the software operates as intended. These tests cover the major capabilities of the code. For all test cases, AMESH Version 2.0 successfully reproduced the target results, which were provided in the AMESH User's Manual (except for minor discrepancies that are clearly attributable to a faulty User's Manual).

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ACKNOWLEDGMENTS

This report was prepared to document work performed by the Center for Nuclear Waste Regulatory Analyses (CNWRA) for the U.S. Nuclear Regulatory Commission (NRC) under Contract No. NRC–02–97–009 and NRC–02–02–012. The activities reported here were performed on behalf of the NRC Office of Nuclear Material Safety and Safeguards, Division of Waste Management. The report is an independent product of the CNWRA and does not necessarily reflect the views or regulatory position of the NRC.

The author is grateful to S. Painter and B. Sagar for their reviews of the manuscript, and to P. Houston for formatting.

QUALITY OF DATA, ANALYSES, AND CODE DEVELOPMENT

DATA: No data were generated for this report.

ANALYSES AND CODES: This report documents quality assurance software validation activities for AMESH Version 2.0. Charles B. Haukwa, of the Earth Sciences Division at Ernest Orlando Lawrence National Laboratory in Berkeley, California, wrote AMESH 2.0 and the AMESH User's Manual (Haukwa, 1998). AMESH 2.0 is controlled in accordance with CNWRA software Technical Operating Procedure TOP–018.

Reference:

Haukwa, C.B. "AMESH: A Mesh Creating Program for the Integral Finite Difference Method." Version 2.0. User's Manual. Berkeley, California: Ernest Orlando Lawrence National Laboratory. 1998.

1 INTRODUCTION

This Software Validation Report documents software validation results for the computer code AMESH Version 2.0 (Haukwa, 1998). AMESH can be used to generate unstructured numerical grids for the purpose of analyzing drift scale and repository scale coupled thermal-hydrologic-chemical processes that could affect the performance of the high-level nuclear waste repository proposed for Yucca Mountain, Nevada. This software may be used in reviewing a license application for the proposed repository. The software validation tests described in this report are required by the Center for Nuclear Waste Regulatory Analyses Technical Operating Procedure TOP–018.

The Voronoi tessellation method is used within AMESH Version 2.0 to generate grids on a two-dimensional plane (Voronoi, 1908; Ahuja, 1982; Fortune, 1987, 1993; Aurenhammer, 1991; Chew and Fortune, 1997). Using this method, the interfaces between neighboring elements are the perpendicular bisectors of the line that connects the element centers (Haukwa, 1998). Interface areas in the vertical direction of a three-dimensional grid are handled as horizontal projections of the two-dimensional areal plane (Haukwa, 1998). For both two-dimensional and three-dimensional grids, the direction of the gravity vector is the cosine of the angle formed between the line connecting the element centers and the vertical (Haukwa, 1998).

Given a single input file named IN, which consists of (i) the geometrical location of element centers (LOCAT); (ii) a description of the domain boundaries (BOUND); and (iii) optional controls on the minimum length allowed for connections (TOLER), AMESH calculates element volumes and connection information. The resulting output files from AMESH are named ELEME, CONNE, and SEGMT (Haukwa, 1998). The ELEME file lists the element names, material type, element volume, and x, y, and z locations of the element centers. The CONNE file lists boundary element and internal element connection information (e.g., areas, connection distances and angles). The SEGMT file lists geometric data, which can be used to plot the grid geometry.

2 SCOPE OF THE VALIDATION

This software validation is for AMESH Version 2.0. Detailed information about the software can be found in the AMESH User's Manual (Haukwa, 1998). This validation covers the major capabilities of the code that may be used in regulatory activities. These include:

1. Uniform two-dimensional grid in a rectangular domain
2. Uniform two-dimensional grid in a rhombohedral domain
3. Uniform three-dimensional grid in a rectangular domain
4. Uniform three-dimensional grid in a rectangular domain with layers sloping 10° in the x-direction
5. Uniform three-dimensional grid in a rectangular domain with layers sloping 10° in the x-direction, and 10° in the y-direction
6. Nonuniform two-dimensional grid in a rhombohedral domain

3 ENVIRONMENT

Validation tests were performed in a UNIX environment on a Sun Microsystems E450 running the Solaris 5.8 operating system (SPARC-based CPU).

4 TEST CASES

4.1 Test 1: Uniform Two-Dimensional Grid Spacing in a Rectangular Domain

4.1.1 Description of the Test

This test is designed for evaluating the capability of AMESH to create a simple uniform two-dimensional grid. The geometry is rectangular, and a grid of 16 elements was used. The Voronoi tessellation method is used to generate grids on a two-dimensional plane (Voronoi, 1908; Ahuja, 1982; Fortune, 1987, 1993; Aurenhammer, 1991; Chew and Fortune, 1997). Using this method, the interfaces between neighboring elements are the perpendicular bisectors of the line that connects the element centers (Haukwa, 1998).

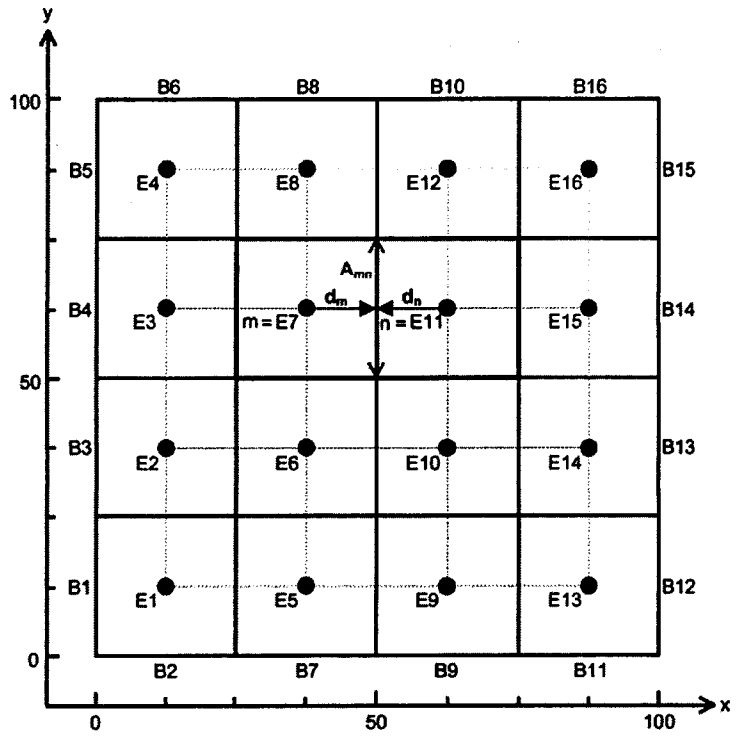

Figure 1. Space Discretization and Geometry for the Integral Finite Difference Method Grid, Test Case 4.1: Uniform Two-Dimensional Grid Spacing in a Rectangular Domain. Solid Lines are indicative of the Voronoi Tessellation Space, While Dashed Lines Illustrate Connections Between Adjacent Element Centers. Elements are Denoted by an *E* with Solid Circles at Element Centers, and Boundaries are Denoted by a *B* (After Haukwa, 1998).

4.1.2 Test Input and Output

The input for this test case is found in Haukwa (1998, p. 16). The test input file is on the accompanying disk: *Test4.1\in.dat*. Test output files are in the same directory: *Test4.1\eleme.dat*; *Test4.1\conne.dat*; and *Test4.1\segmt.dat*.

4.1.3 Target Solution

The target output files for the grid-generation test can be found in Haukwa (1998, pp. 17–18). An error (discussed below) in the apparent target output for the CONNE file exists in the AMESH User's Manual (i.e., Haukwa, 1998).

4.1.4 Results

The grid-generating program executed to completion without error. Haukwa (1998) provides, either in part or in full, the three target output files that should be generated by running AMESH with the given input (i.e., ELEME, SEGMT, and CONNE).

Haukwa (1998) provides the target output file ELEME in full, and it is in complete agreement with the test ELEME output file generated by running AMESH 2.0. A simple hand calculation is indicative that AMESH calculates the correct element volume given the input file:

$$V_{E7} = 25\ \text{m} \times 25\ \text{m} \times 10\ \text{m} = 6.25 \times 10^3\ \text{m}^3$$

The target output file SEGMT is provided in part, and is also in agreement with the test SEGMT output file that is generated by running AMESH 2.0. That is, the actual test output files named ELEME and SEGMT identically match the target output files of the same name.

An oversight was discovered in the AMESH User's Manual (Haukwa, 1998, p. 17). The uninitiated user is led to believe that the AMESH-generated CONNE output file contains entries for connected element pairs only, rather than for elemental boundaries, as well. Discovery of this oversight occurred when running this test case. The target output file CONNE is *apparently* provided in full by Haukwa (1998), yet it systematically neglects the lines of output pertaining to boundary elements that are generated in the test CONNE output file by running AMESH 2.0. This discrepancy is clearly an oversight on the part of the author of the AMESH User's Manual. This error in the apparent target output file CONNE provided in the User's Manual for this test case does not affect the proper operation of the AMESH 2.0 code. Two simple hand calculations are indicative that AMESH calculates the correct interface distances and element areas.

When element *m* = E7, and *n* = E11:

$$d_{E7} = (\text{Location of E11} - \text{Location of E7})/2 = (62.5\ \text{m} - 37.5\ \text{m})/2 = 12.5\ \text{m}$$

$$A_{E7E11} = (\text{Location of E11} - \text{Location of E7}) \times \text{thickness}$$

$$= (62.5\ \text{m} - 37.5\ \text{m}) \times 10\ \text{m} = 2.5 \times 10^2\ \text{m}^2$$

4.2 Test 2: Uniform Two-Dimensional Grid Spacing in a Rhombohedral Domain

4.2.1 Description of the Test

This test is also designed for evaluating the capability of AMESH to create a uniform two-dimensional grid. The geometry is rhombohedral, and a grid of 16 elements was used.

4.2.2 Test Input and Output

The input for this test case is found in Haukwa (1998, p. 20). The test input file is on the accompanying disk: *Test4.2\in.dat*. Test output files are in the same directory: *Test4.2\eleme.dat*; *Test4.2\conne.dat*; and *Test4.2\segmt.dat*.

4.2.3 Target Solution

The target output files for the grid-generation test can be found in Haukwa (1998, pp. 21–23).

4.2.4 Results

The grid-generating program executed to completion without error. The actual test output files identically match the target output files.

4.3 Test 3: Uniform Three-Dimensional Grid Spacing in a Rectangular Domain

4.3.1 Description of the Test

Recalling the description of the two-dimensional grid, the vertical direction interface areas of a three-dimensional grid are always treated as horizontal projections of the two-dimensional areal plane. This test is designed for evaluating the capability of AMESH to create a uniform three-dimensional grid. The geometry is rectangular, and a grid of 64 elements (16 areal elements × 4 vertical layers) was used.

4.3.2 Test Input and Output

The input for this test case is found in Haukwa (1998, pp. 25–26). The test input file is on the accompanying disk: *Test4.3\in.dat*. Test output files are in the same directory: *Test4.3\eleme.dat*; *Test4.3\conne.dat*; and *Test4.3\segmt.dat*.

4.3.3 Target Solution

The target output files for the grid-generation test can be found in Haukwa (1998, pp. 27–29).

4.3.4 Results

The grid-generating program executed to completion without error, and the actual output files identically match the target output files, with one exception, which is described below.

This test case exhibits a discrepancy in the actual CONNE output file when compared to the expected output that is indicated by the User's Manual. ISOT, as described by Haukwa (1998), is the direction of the permeability factor, and according to the User's Manual the magnitude of ISOT is expected to be 3 between element pairs with a vertical association (the inference is that ISOT is a flag, where a value of 1 corresponds to the x-direction, a value of 2 corresponds to the y-direction, and a value of 3 corresponds to the z-direction). However, when AMESH 2.0 is run from the given input file, all of the ISOT magnitudes are 1. Upon further investigation of the software, it was observed that the ISOT parameter in AMESH 2.0 is hardwired to a value of 1. Thus, this discrepancy is attributable to an out-of-date User's Manual, and ISOT is recognized to be nothing more than a vestigial parameter from previous versions of the software.

ISOT is not used in preparing MULTIFLO input, or in any regulatory analysis.

4.4 Test 4: Uniform Three-Dimensional Grid Spacing in a Rectangular Domain; Layers Slope 10° in the x-Direction

4.4.1 Description of the Test

This test is designed for evaluating the capability of AMESH to create a uniform three-dimensional grid with sub-vertical layers dipping 10° in the x-direction. The geometry is rectangular, and a grid of 64 elements (16 areal elements × 4 vertical layers) was used.

4.4.2 Test Input and Output

The apparent input for this test case is found in Haukwa (1998, pp. 30–31). Haukwa (1998) erred by an omission in the example input file for this test case. That the domain is to be rectangular, is made clear in the example's title as well as in the x- and y-coordinates provided in the LOCAT block. However, the BOUND block, which defines the aerial boundaries of the grid, only provides three pairs of x-y coordinates, forming a right-triangular system half the size of the intended rectangular domain. As stated in Haukwa (1998, p. 13), the x-y coordinates provided in the LOCAT block that are outside the triangular BOUND block are ignored, and the target output in files ELEME, CONNE, and SEGMT are not obtained. In order to obtain the target output, a fourth x-y pair (100,0) must be included in the BOUND block. The corrected test input file is on the accompanying disk: *Test4.4\in.dat*. Test output files are in the same directory: *Test4.4\eleme.dat*; *Test4.4\conne.dat*; and *Test4.4\segmt.dat*.

4.4.3 Target Solution

The target output files for the grid-generation test can be found in Haukwa (1998, pp. 32–34).

4.4.4 Results

The grid-generating program executed to completion without error, and the actual output files identically match the target output files, with one exception, which is described below.

As discussed above for Test Case 4.3, this test case exhibits a discrepancy in the actual CONNE output file when compared to the expected output that is indicated by the User's Manual. ISOT, as described by Haukwa (1998), is the direction of the permeability factor. According to the User's Manual, the magnitude of ISOT is expected to be 3 between element pairs with a vertical

association. However, when AMESH 2.0 is run from the given input file, all of the ISOT magnitudes are 1. Upon further investigation of the software code, it was observed that the ISOT parameter in AMESH 2.0 is hardwired to a value of 1. Thus, this discrepancy is attributable to an out-of-date User's Manual, and ISOT is recognized to be nothing more than a vestigial parameter from previous versions of the software. ISOT is not used in preparing MULTIFLO input, or in any regulatory analysis. This error of omission in the test case input file, as provided in the User's Manual, does not affect the proper operation of the AMESH Version 2.0 code.

4.5 Test 5: Uniform Three-Dimensional Grid Spacing in a Rectangular Domain; Layers Slope 10° in the x-Direction, and 10° in the y-Direction

4.5.1 Description of the Test

This test is designed for evaluating the capability of AMESH to create a uniform three-dimensional grid with subvertical layers dipping 10° in the x-direction and 10° in the y-direction. The geometry is rectangular, and a grid of 64 elements (16 areal elements × 4 vertical layers) was used.

4.5.2 Test Input and Output

The input for this test case is found in Haukwa (1998, pp. 35–36). The test input file is on the accompanying disk: *Test4.5\in.dat*. Test output files are in the same directory: *Test4.5\eleme.dat*; *Test4.5\conne.dat*; and *Test4.5\segmt.dat*.

4.5.3 Target Solution

The target output files for the grid-generation test can be found in Haukwa (1998, pp. 37–138). Note that Haukwa (1998) does not provide target output for file SEGMT.

4.5.4 Results

The grid-generating program executed to completion without error. The target output files ELEME and CONNE identically match the actual output files.

4.6 Test 6: Nonuniform Two-Dimensional Grid Spacing in a Rhombohedral Domain

4.6.1 Description of the Test

This test is designed for evaluating the capability of AMESH to create a nonuniform two-dimensional grid. The geometry is rhombohedral, and a grid of 16 elements was used.

4.6.2 Test Input and Output

The input for this test case is found in Haukwa (1998, p. 39). The test input file is on the accompanying disk: *Test4.6\in.dat*. Test output files are in the same directory: *Test4.6\eleme.dat*; *Test4.6\conne.dat*; and *Test4.6\segmt.dat*.

4.6.3 Target Solution

The target output files for the grid-generation test can be found in Haukwa (1998, pp. 40–42).

4.6.4 Results

The grid-generating program executed to completion without error. The target output files identically match the actual output files.

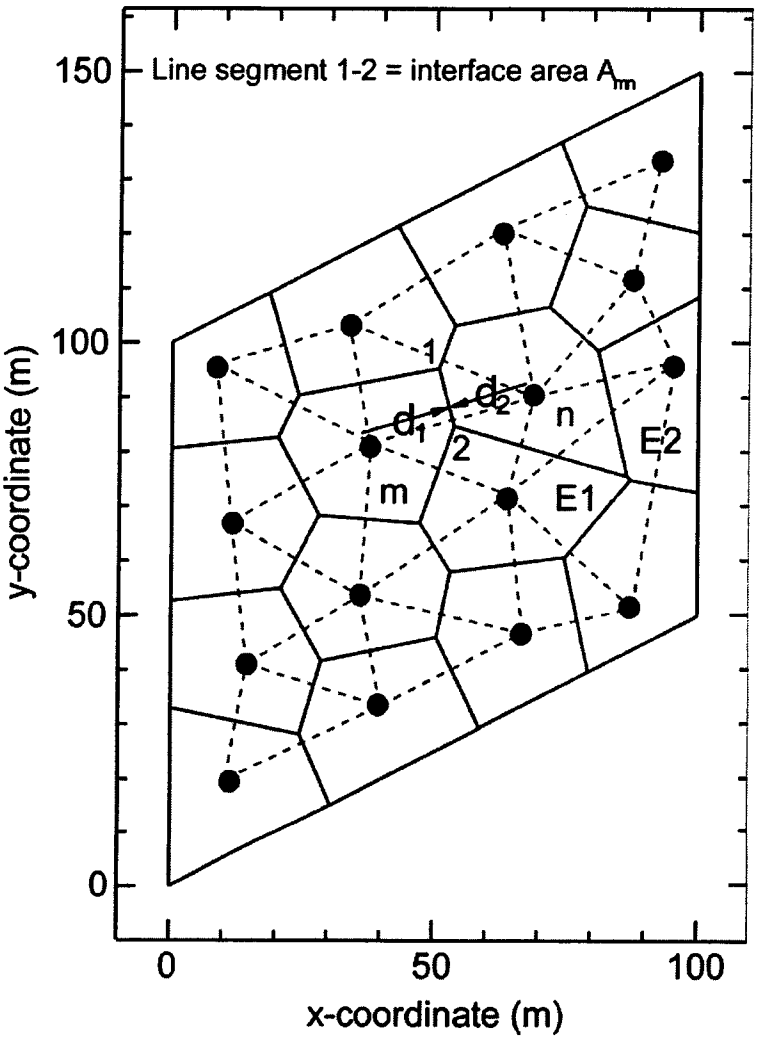

Figure 2. Space Discretization and Geometry for the Integral Finite Difference Method Grid, Test Case 4.6: Nonuniform Two-Dimensional Grid Spacing in a Rhombohedral Domain. Solid Lines Are Voronoi Tessellation Space, While Dashed Lines Connect Adjacent Element Centers that Are Represented as Solid Circles. Note that Elements E1 and E2 Share a Small Interface, which is an Invalid Connection. This Type of Interface in a Nonuniform Grid Can Be Corrected by Adjusting the Coordinates of E1, E2, and n, so that the Interface Area of E1/E2 Is Either Increased or Eliminated (After Haukwa, 1998).

5 KNOWN PROBLEMS

For all test cases, AMESH Version 2.0 successfully reproduced the target results that were provided in the AMESH User's Manual, except for three minor discrepancies that are clearly attributable to a faulty User's Manual.

First, an oversight was discovered in the AMESH User's Manual (Haukwa, 1998, p. 17). The uninitiated user is led to believe that the AMESH-generated CONNE output file contains entries for connected element pairs only, rather than for elemental boundaries, as well. Discovery of this oversight occurred when running the simplest test case provided by the code's author (Test Case 4.1). The target output file CONNE is *apparently* provided in full by Haukwa (1998), yet it systematically neglects the lines of output pertaining to boundary elements that are generated in the test CONNE output file by running AMESH 2.0. This discrepancy is clearly an oversight on the part of the author of the AMESH User's Manual. This error in the apparent target output file named CONNE, which was provided in the User's Manual does not affect the proper operation of the AMESH Version 2.0 code.

Second, ISOT, as described by Haukwa (1998), is the direction of the permeability factor, and according to the User's Manual the value of ISOT is expected to be 3 between element pairs with a vertical association (the inference is that ISOT is a flag, where a value of 1 corresponds to the x-direction, a value of 2 corresponds to the y-direction, and a value of 3 corresponds to the z-direction). Upon investigation of the software code, it was observed that the ISOT parameter in AMESH 2.0 is hardwired to a value of 1. Thus, this discrepancy is attributable to an out-of-date User's Manual, and ISOT is recognized to be nothing more than a vestigial parameter from previous versions of the software. ISOT is not used in preparing MULTIFLO input, or in any regulatory analysis. This error in the User's Manual does not affect the proper operation of the AMESH Version 2.0 code.

Third, Haukwa (1998) erred by an omission in the example input file for this Test Case 4.4. That the domain was to be rectangular was made clear in the title of the example, as well as in the x-and y-coordinates provided in the LOCAT block. However, the BOUND block, which defines the aerial boundaries of the grid, only provides three pairs of x-y coordinates, forming a right-triangular system half the size of the intended rectangular domain. As stated in Haukwa (1998, p. 13), the x-y coordinates provided in the LOCAT block that are outside the triangular BOUND block are ignored, and the target output in files ELEME, CONNE, and SEGMT are not obtained. In order to obtain the target output, a fourth x-y pair (100,0) must be included in the BOUND block. This error of omission in the test case input file, as provided in the User's Manual, does not affect the proper operation of the AMESH Version 2.0 code.

6 CONCLUSIONS

With the minor exceptions listed in Section 5, results of the validation tests were consistent with the target results, thereby providing confidence that the major capabilities probed by these tests are correctly implemented in AMESH.

7 REFERENCES

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Haukwa, C.B. "AMESH: A Mesh Creating Program for the Integral Finite Difference Method." Version 2.0. User's Manual. Berkeley, California: Ernest Orlando Lawrence National Laboratory. 1998.

Voronoi, G.F. "Nouvelles Applications Des Parametres Continus à La Theorie Des Formes Quadratiques. Deuxième Mémorie: Recherches Sur Les Paralléloèdres Primitifs." *Journal fur die Reine und Angewandte Mathematik*. Vol. 134. pp. 198–287. 1908.

The User's Manual description of CONNE output (page 14 and 15) ensues, followed by our amended description:

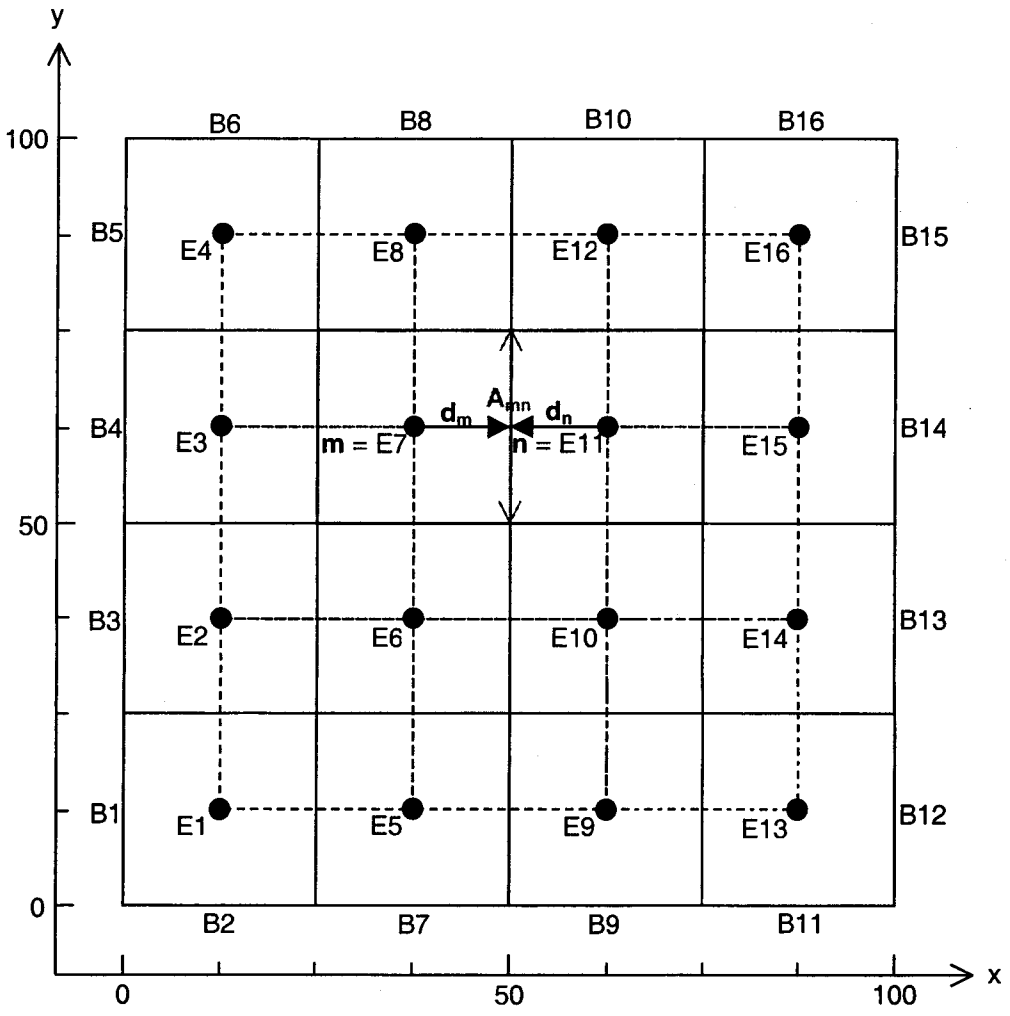
> "**CONNE** or **conne** (a5) :Block name of connection information
>
> a5,a5,18x, i2.4e10.0 :*Element1, Element2, isot, d1,d2, area, beta*
>
> .....
>
> .....
>
> blank line
>
> where *element1*, *element2* are the connected element pair; '*isot*' is the direction of permeability factor; *d1* is the distance from the center of *element1* to the interface with *element2*; *d2* is distance from the center of *element2* to the interface with *elemet1*; *area* is the interface area (minimum) between *elemnt1* and *element2*; and *beta* is the cosine of the angle formed by the line joining the centers of *element1* and *element2*, measured from the vertical at the center of *element1*." [Haukwa, 1998]

In point of fact, the AMESH User's Manual for this section should read as follows:

> **CONNE** or **conne** (a5) :Block name of connection information
>
> a5,a5,18x, i2.4e10.0 :*element1, element2* or *boundary#, isot, d1, d2 ,area, beta*
>
> .....
>
> .....
>
> blank line
>
> where *element1*, *element2* are the connected element pair **and** *element1,boundary#* simply indicates that *element1* is on boundary#: in this case what would otherwise be an *element2* name is instead preceded by a star, as in '*xxxx'; '*isot*' is the direction of permeability factor; *d1* is the distance from the center of *element1* to the interface with *element2* **or** the distance from the center of *element1* to the boundary; *d2* is the

distance from the center of *element2* to the interface with *element1* **or** *d2* is 0.000e+00 if *element1* is a boundary element; *area* is the interface area (minimum) between *element1* and *element2* **or** *area* is the *element1* area at *boundary#*; and *beta* is the cosine of the angle formed by the line joining the centers of *element1* and *element2*, measured from the vertical at the center of *element1*.

Example 3.3.1 Uniform 2D grid spacing in a rectangular domain
Test Case and Expected Output as Provided in the AMESH User's Manual



Solid lines are Voronoi tessellation space; dashed lines illustrate connections between adjacent elements; elements denoted by E with solid circles at element centers; boundaries denoted by B.

filename: IN

```
locat
a11 1  101     12.5000000000  12.5000000000  50.00000       10.0000
a11 2  101     12.5000000000  37.5000000000  50.00000       10.0000
a11 3  101     12.5000000000  62.5000000000  50.00000       10.0000
a11 4  101     12.5000000000  87.5000000000  50.00000       10.0000
a11 5  101     37.5000000000  12.5000000000  50.00000       10.0000
a11 6  101     37.5000000000  37.5000000000  50.00000       10.0000
a11 7  101     37.5000000000  62.5000000000  50.00000       10.0000
a11 8  101     37.5000000000  87.5000000000  50.00000       10.0000
a11 9  101     62.5000000000  12.5000000000  50.00000       10.0000
a1110  101     62.5000000000  37.5000000000  50.00000       10.0000
a1111  101     62.5000000000  62.5000000000  50.00000       10.0000
a1112  101     62.5000000000  87.5000000000  50.00000       10.0000
a1113  101     87.5000000000  12.5000000000  50.00000       10.0000
a1114  101     87.5000000000  37.5000000000  50.00000       10.0000
a1115  101     87.5000000000  62.5000000000  50.00000       10.0000
a1116  101     87.5000000000  87.5000000000  50.00000       10.0000

bound
0.0    0.0
0.0    100.0
100.0  100.0
100.0  0.0

toler
0.5
```

filename: ELEME

```
eleme
a11 1  rock1   6.250e+03      12.500  12.500  50.0000
a11 2  rock1   6.250e+03      12.500  37.500  50.0000
a11 3  rock1   6.250e+03      12.500  62.500  50.0000
a11 4  rock1   6.250e+03      12.500  87.500  50.0000
a11 5  rock1   6.250e+03      37.500  12.500  50.0000
a11 6  rock1   6.250e+03      37.500  37.500  50.0000
a11 7  rock1   6.250e+03      37.500  62.500  50.0000
a11 8  rock1   6.250e+03      37.500  87.500  50.0000
a11 9  rock1   6.250e+03      62.500  12.500  50.0000
a1110  rock1   6.250e+03      62.500  37.500  50.0000
a1111  rock1   6.250e+03      62.500  62.500  50.0000
a1112  rock1   6.250e+03      62.500  87.500  50.0000
a1113  rock1   6.250e+03      87.500  12.500  50.0000
a1114  rock1   6.250e+03      87.500  37.500  50.0000
a1115  rock1   6.250e+03      87.500  62.500  50.0000
a1116  rock1   6.250e+03      87.500  87.500  50.0000
```

filename: CONNE

```
a11 1  a11 2   1      1.250e+01      1.250e+01      2.500e+02      0.000e+00
a11 1  a11 5   1      1.250e+01      1.250e+01      2.500e+02      0.000e+00
a11 2  a11 3   1      1.250e+01      1.250e+01      2.500e+02      0.000e+00
a11 2  a11 6   1      1.250e+01      1.250e+01      2.500e+02      0.000e+00
a11 3  a11 4   1      1.250e+01      1.250e+01      2.500e+02      0.000e+00
a11 3  a11 7   1      1.250e+01      1.250e+01      2.500e+02      0.000e+00
a11 4  a11 8   1      1.250e+01      1.250e+01      2.500e+02      0.000e+00
a11 5  a11 6   1      1.250e+01      1.250e+01      2.500e+02      0.000e+00
a11 5  a11 9   1      1.250e+01      1.250e+01      2.500e+02      0.000e+00
a11 6  a11 7   1      1.250e+01      1.250e+01      2.500e+02      0.000e+00
a11 6  a1110   1      1.250e+01      1.250e+01      2.500e+02      0.000e+00
a11 7  a11 8   1      1.250e+01      1.250e+01      2.500e+02      0.000e+00
a11 7  a1111   1      1.250e+01      1.250e+01      2.500e+02      0.000e+00
a11 8  a1112   1      1.250e+01      1.250e+01      2.500e+02      0.000e+00
a11 9  a1110   1      1.250e+01      1.250e+01      2.500e+02      0.000e+00
a11 9  a1113   1      1.250e+01      1.250e+01      2.500e+02      0.000e+00
a1110  a1111   1      1.250e+01      1.250e+01      2.500e+02      0.000e+00
a1110  a1114   1      1.250e+01      1.250e+01      2.500e+02      0.000e+00
a1111  a1112   1      1.250e+01      1.250e+01      2.500e+02      0.000e+00
a1111  a1115   1      1.250e+01      1.250e+01      2.500e+02      0.000e+00
a1112  a1116   1      1.250e+01      1.250e+01      2.500e+02      0.000e+00
a1113  a1114   1      1.250e+01      1.250e+01      2.500e+02      0.000e+00
a1114  a1115   1      1.250e+01      1.250e+01      2.500e+02      0.000e+00
a1115  a1116   1      1.250e+01      1.250e+01      2.500e+02      0.000e+00
```

filename: SEGMT

```
0      0      0      25     0      a11 1   *    1
0      25     25     25     1      a11 1   a11 2
25     25     25     0      1      a11 1   a11 5
25     0      0      0      0      a11 1   *    2
0      25     0      50     0      a11 2   *    3
0      50     25     50     1      a11 2   a11 3
25     50     25     25     1      a11 2   a11 6
25     25     0      25     0      a11 2   a11 1
0      50     0      75     0      a11 3   *    4
0      75     25     75     1      a11 3   a11 4
25     75     25     50     1      a11 3   a11 7
25     50     0      50     0      a11 3   a11 2
0      100    25     100    0      a11 4   *    5
25     100    25     75     1      a11 4   a11 8
25     75     0      75     0      a11 4   a11 3
0      75     0      100    0      a11 4   *    6
25     0      25     25     0      a11 5   a11 1
25     25     50     25     1      a11 5   a11 6
50     25     50     0      1      a11 5   a11 9
50     0      25     0      0      a11 5   *    7
....
50     50     50     75     0      a1111   a11 7
50     75     75     75     1      a1111   a1112
75     75     75     50     1      a1111   a1115
....
75     0      75     25     0      a1113   a11 9
75     25     100    25     1      a1113   a1114
100    25     100    0      0      a1113   *   12
75     25     75     50     0      a1114   a1110
75     50     100    50     1      a1114   a1115
100    50     100    25     0      a1114   *   13
100    25     75     25     0      a1114   a1113
100    50     75     50     0      a1115   a1114
75     50     75     75     0      a1115   a1111
75     75     100    75     1      a1115   a1116
100    75     100    50     0      a1115   *   14
100    100    100    75     0      a1116   *   15
100    75     75     75     0      a1116   a1115
75     75     75     100    0      a1116   a1112
75     100    100    100    0      a1116   *   16
```

Example 3.3.1 Uniform 2D grid spacing in a rectangular domain
Acceptance Test: Results Generated by AMESH

filename: IN

```
locat
a11 1 101     12.5000000000  12.5000000000  50.00000       10.0000
a11 2 101     12.5000000000  37.5000000000  50.00000       10.0000
a11 3 101     12.5000000000  62.5000000000  50.00000       10.0000
a11 4 101     12.5000000000  87.5000000000  50.00000       10.0000
a11 5 101     37.5000000000  12.5000000000  50.00000       10.0000
a11 6 101     37.5000000000  37.5000000000  50.00000       10.0000
a11 7 101     37.5000000000  62.5000000000  50.00000       10.0000
a11 8 101     37.5000000000  87.5000000000  50.00000       10.0000
a11 9 101     62.5000000000  12.5000000000  50.00000       10.0000
a1110 101     62.5000000000  37.5000000000  50.00000       10.0000
a1111 101     62.5000000000  62.5000000000  50.00000       10.0000
a1112 101     62.5000000000  87.5000000000  50.00000       10.0000
a1113 101     87.5000000000  12.5000000000  50.00000       10.0000
a1114 101     87.5000000000  37.5000000000  50.00000       10.0000
a1115 101     87.5000000000  62.5000000000  50.00000       10.0000
a1116 101     87.5000000000  87.5000000000  50.00000       10.0000

bound
0.0   0.0
0.0   100.0
100.0 100.0
100.0 0.0

toler
0.5
```

filename: ELEME

```
eleme
a11 1          rock1 6.250e+03                12.500       12.500       50.0000
a11 2          rock1 6.250e+03                12.500       37.500       50.0000
a11 3          rock1 6.250e+03                12.500       62.500       50.0000
a11 4          rock1 6.250e+03                12.500       87.500       50.0000
a11 5          rock1 6.250e+03                37.500       12.500       50.0000
a11 6          rock1 6.250e+03                37.500       37.500       50.0000
a11 7          rock1 6.250e+03                37.500       62.500       50.0000
a11 8          rock1 6.250e+03                37.500       87.500       50.0000
a11 9          rock1 6.250e+03                62.500       12.500       50.0000
a1110          rock1 6.250e+03                62.500       37.500       50.0000
a1111          rock1 6.250e+03                62.500       62.500       50.0000
a1112          rock1 6.250e+03                62.500       87.500       50.0000
a1113          rock1 6.250e+03                87.500       12.500       50.0000
a1114          rock1 6.250e+03                87.500       37.500       50.0000
a1115          rock1 6.250e+03                87.500       62.500       50.0000
a1116          rock1 6.250e+03                87.500       87.500       50.0000
```

Example Volume Calculation:

Element a11 1: Element Volume = 25 m × 25 m × 10 m = 6.25×10^3

filename: CONNE

```
conne
a11 1 *   1                    1 1.250e+01 0.000e+00 2.500e+02
a11 1 a11 2                    1 1.250e+01 1.250e+01 2.500e+02
a11 1 a11 5                    1 1.250e+01 1.250e+01 2.500e+02
a11 1 *   2                    1 1.250e+01 0.000e+00 2.500e+02
a11 2 *   3                    1 1.250e+01 0.000e+00 2.500e+02
a11 2 a11 3                    1 1.250e+01 1.250e+01 2.500e+02
a11 2 a11 6                    1 1.250e+01 1.250e+01 2.500e+02
a11 3 *   4                    1 1.250e+01 0.000e+00 2.500e+02
a11 3 a11 4                    1 1.250e+01 1.250e+01 2.500e+02
a11 3 a11 7                    1 1.250e+01 1.250e+01 2.500e+02
a11 4 *   5                    1 1.250e+01 0.000e+00 2.500e+02
a11 4 a11 8                    1 1.250e+01 1.250e+01 2.500e+02
a11 4 *   6                    1 1.250e+01 0.000e+00 2.500e+02
a11 5 a11 6                    1 1.250e+01 1.250e+01 2.500e+02
a11 5 a11 9                    1 1.250e+01 1.250e+01 2.500e+02
a11 5 *   7                    1 1.250e+01 0.000e+00 2.500e+02
a11 6 a11 7                    1 1.250e+01 1.250e+01 2.500e+02
a11 6 a1110                    1 1.250e+01 1.250e+01 2.500e+02
a11 7 a11 8                    1 1.250e+01 1.250e+01 2.500e+02
a11 7 a1111                    1 1.250e+01 1.250e+01 2.500e+02
a11 8 *   8                    1 1.250e+01 0.000e+00 2.500e+02
a11 8 a1112                    1 1.250e+01 1.250e+01 2.500e+02
a11 9 a1110                    1 1.250e+01 1.250e+01 2.500e+02
a11 9 a1113                    1 1.250e+01 1.250e+01 2.500e+02
a11 9 *   9                    1 1.250e+01 0.000e+00 2.500e+02
a1110 a1111                    1 1.250e+01 1.250e+01 2.500e+02
a1110 a1114                    1 1.250e+01 1.250e+01 2.500e+02
a1111 a1112                    1 1.250e+01 1.250e+01 2.500e+02
a1111 a1115                    1 1.250e+01 1.250e+01 2.500e+02
a1112 *  10                    1 1.250e+01 0.000e+00 2.500e+02
a1112 a1116                    1 1.250e+01 1.250e+01 2.500e+02
a1113 *  11                    1 1.250e+01 0.000e+00 2.500e+02
a1113 a1114                    1 1.250e+01 1.250e+01 2.500e+02
a1113 *  12                    1 1.250e+01 0.000e+00 2.500e+02
a1114 a1115                    1 1.250e+01 1.250e+01 2.500e+02
a1114 *  13                    1 1.250e+01 0.000e+00 2.500e+02
a1115 a1116                    1 1.250e+01 1.250e+01 2.500e+02
a1115 *  14                    1 1.250e+01 0.000e+00 2.500e+02
a1116 *  15                    1 1.250e+01 0.000e+00 2.500e+02
a1116 *  16                    1 1.250e+01 0.000e+00 2.500e+02
```

Example Distance Calculation, Element m = `a11  1`, Element n = `a11  2`

d_m = (Element n center – Element m center)/2 = (37.5 m – 12.5 m)/2 = 12.5 m

d_n = (Element n center – Element m center)/2 = (37.5 m – 12.5 m)/2 = 12.5 m

Example Area Calculation

Area A_{mn} = (Element n center – Element m center) × thickness =
(37.5 m – 12.5 m) × 10 m = 2.5×10^2 m^2

filename: SEGMT

0	0	0	25	0	a11 1	* 1
0	25	25	25	1	a11 1	a11 2
25	25	25	0	1	a11 1	a11 5
25	0	0	0	0	a11 1	* 2
0	25	0	50	0	a11 2	* 3
0	50	25	50	1	a11 2	a11 3
25	50	25	25	1	a11 2	a11 6
25	25	0	25	0	a11 2	a11 1
0	50	0	75	0	a11 3	* 4
0	75	25	75	1	a11 3	a11 4
25	75	25	50	1	a11 3	a11 7
25	50	0	50	0	a11 3	a11 2
0	100	25	100	0	a11 4	* 5
25	100	25	75	1	a11 4	a11 8
25	75	0	75	0	a11 4	a11 3
0	75	0	100	0	a11 4	* 6
25	0	25	25	0	a11 5	a11 1
25	25	50	25	1	a11 5	a11 6
50	25	50	0	1	a11 5	a11 9
50	0	25	0	0	a11 5	* 7
25	25	25	50	0	a11 6	a11 2
25	50	50	50	1	a11 6	a11 7
50	50	50	25	1	a11 6	a1110
50	25	25	25	0	a11 6	a11 5
25	50	25	75	0	a11 7	a11 3
25	75	50	75	1	a11 7	a11 8
50	75	50	50	1	a11 7	a1111
50	50	25	50	0	a11 7	a11 6
25	75	25	100	0	a11 8	a11 4
25	100	50	100	0	a11 8	* 8
50	100	50	75	1	a11 8	a1112
50	75	25	75	0	a11 8	a11 7
50	0	50	25	0	a11 9	a11 5
50	25	75	25	1	a11 9	a1110
75	25	75	0	1	a11 9	a1113
75	0	50	0	0	a11 9	* 9
50	25	50	50	0	a1110	a11 6
50	50	75	50	1	a1110	a1111
75	50	75	25	1	a1110	a1114
75	25	50	25	0	a1110	a11 9
50	50	50	75	0	a1111	a11 7
50	75	75	75	1	a1111	a1112
75	75	75	50	1	a1111	a1115
75	50	50	50	0	a1111	a1110
75	75	50	75	0	a1112	a1111
50	75	50	100	0	a1112	a11 8
50	100	75	100	0	a1112	* 10
75	100	75	75	1	a1112	a1116
100	0	75	0	0	a1113	* 11
75	0	75	25	0	a1113	a11 9
75	25	100	25	1	a1113	a1114
100	25	100	0	0	a1113	* 12
75	25	75	50	0	a1114	a1110
75	50	100	50	1	a1114	a1115
100	50	100	25	0	a1114	* 13
100	25	75	25	0	a1114	a1113
100	50	75	50	0	a1115	a1114
75	50	75	75	0	a1115	a1111
75	75	100	75	1	a1115	a1116
100	75	100	50	0	a1115	* 14
100	100	100	75	0	a1116	* 15
100	75	75	75	0	a1116	a1115
75	75	75	100	0	a1116	a1112
75	100	100	100	0	a1116	* 16

Example 3.3.2 Uniform 2D grid spacing in a rhombohedron domain
Test Case and Expected Output as Provided in the AMESH User's Manual

filename: IN

```
locat
a11 1 101     12.5000000000   18.7500000000 50.00000       10.0000
a11 2 101     12.5000000000   43.7500000000 50.00000       10.0000
a11 3 101     12.5000000000   68.7500000000 50.00000       10.0000
a11 4 101     12.5000000000   93.7500000000 50.00000       10.0000
a11 5 101     37.5000000000   31.2500000000 50.00000       10.0000
a11 6 101     37.5000000000   56.2500000000 50.00000       10.0000
a11 7 101     37.5000000000   81.2500000000 50.00000       10.0000
a11 8 101     37.5000000000  106.2500000000 50.00000       10.0000
a11 9 101     62.5000000000   43.7500000000 50.00000       10.0000
a1110 101     62.5000000000   68.7500000000 50.00000       10.0000
a1111 101     62.5000000000   93.7500000000 50.00000       10.0000
a1112 101     62.5000000000  118.7500000000 50.00000       10.0000
a1113 101     87.5000000000   56.2500000000 50.00000       10.0000
a1114 101     87.5000000000   81.2500000000 50.00000       10.0000
a1115 101     87.5000000000  106.2500000000 50.00000       10.0000
a1116 101     87.5000000000  131.2500000000 50.00000       10.0000

bound
0.0   0.0
0.0   100.0
100.0 150.0
100.0 50.0

toler
0.5
```

filename: ELEME

```
eleme
a11 1 rock1   6.465e+03      12.500  18.750  50.0000
a11 2 rock1   6.250e+03      12.500  43.750  50.0000
a11 3 rock1   6.250e+03      12.500  68.750  50.0000
a11 4 rock1   6.035e+03      12.500  93.750  50.0000
a11 5 rock1   6.250e+03      37.500  31.250  50.0000
a11 6 rock1   6.250e+03      37.500  56.250  50.0000
a11 7 rock1   6.250e+03      37.500  81.250  50.0000
a11 8 rock1   6.250e+03      37.500  106.250 50.0000
a11 9 rock1   6.250e+03      62.500  43.750  50.0000
a1110 rock1   6.250e+03      62.500  68.750  50.0000
a1111 rock1   6.250e+03      62.500  93.750  50.0000
a1112 rock1   6.250e+03      62.500  118.750 50.0000
a1113 rock1   6.035e+03      87.500  56.250  50.0000
a1114 rock1   6.250e+03      87.500  81.250  50.0000
a1115 rock1   6.250e+03      87.500  106.250 50.0000
a1116 rock1   6.465e+03      87.500  131.250 50.0000
```

filename: CONNE

```
conne
a11 1  a11 2   1       1.250e+01       1.250e+01       2.188e+02       0.000e+00
a11 1  a11 5   1       1.398e+01       1.398e+01       1.817e+02       0.000e+00
a11 2  a11 3   1       1.250e+01       1.250e+01       2.188e+02       0.000e+00
a11 2  a11 6   1       1.398e+01       1.398e+01       1.398e+02       0.000e+00
a11 2  a11 5   1       1.398e+01       1.398e+01       1.398e+02       0.000e+00
a11 3  a11 4   1       1.250e+01       1.250e+01       2.188e+02       0.000e+00
a11 3  a11 7   1       1.398e+01       1.398e+01       1.398e+02       0.000e+00
a11 3  a11 6   1       1.398e+01       1.398e+01       1.398e+02       0.000e+00
a11 4  a11 8   1       1.398e+01       1.398e+01       1.817e+02       0.000e+00
a11 4  a11 7   1       1.398e+01       1.398e+01       1.398e+02       0.000e+00
a11 5  a11 6   1       1.250e+01       1.250e+01       1.875e+02       0.000e+00
a11 5  a11 9   1       1.398e+01       1.398e+01       1.817e+02       0.000e+00
a11 6  a11 7   1       1.250e+01       1.250e+01       1.875e+02       0.000e+00
a11 6  a1110   1       1.398e+01       1.398e+01       1.398e+02       0.000e+00
a11 6  a11 9   1       1.398e+01       1.398e+01       1.398e+02       0.000e+00
a11 7  a11 8   1       1.250e+01       1.250e+01       1.875e+02       0.000e+00
a11 7  a1111   1       1.398e+01       1.398e+01       1.398e+02       0.000e+00
a11 7  a1110   1       1.398e+01       1.398e+01       1.398e+02       0.000e+00
a11 8  a1112   1       1.398e+01       1.398e+01       1.817e+02       0.000e+00
a11 8  a1111   1       1.398e+01       1.398e+01       1.398e+02       0.000e+00
a11 9  a1110   1       1.250e+01       1.250e+01       1.875e+02       0.000e+00
a11 9  a1113   1       1.398e+01       1.398e+01       1.817e+02       0.000e+00
a1110  a1111   1       1.250e+01       1.250e+01       1.875e+02       0.000e+00
a1110  a1114   1       1.398e+01       1.398e+01       1.398e+02       0.000e+00
a1110  a1113   1       1.398e+01       1.398e+01       1.398e+02       0.000e+00
a1111  a1112   1       1.250e+01       1.250e+01       1.875e+02       0.000e+00
a1111  a1115   1       1.398e+01       1.398e+01       1.398e+02       0.000e+00
a1111  a1114   1       1.398e+01       1.398e+01       1.398e+02       0.000e+00
a1112  a1116   1       1.398e+01       1.398e+01       1.817e+02       0.000e+00
a1112  a1115   1       1.398e+01       1.398e+01       1.398e+02       0.000e+00
a1113  a1114   1       1.250e+01       1.250e+01       2.188e+02       0.000e+00
a1114  a1115   1       1.250e+01       1.250e+01       2.188e+02       0.000e+00
a1115  a1116   1       1.250e+01       1.250e+01       2.188e+02       0.000e+00
```

filename: SEGMT

```
0               0       0       31.25   0       a11 1   *   1
0               31.25   21.875  31.25   1       a11 1   a11 2
21.875          31.25   30      15      1       a11 1   a11 5
30              15      0       0       0       a11 1   *   2
0               31.25   0       56.25   0       a11 2   *   3
0               56.25   21.875  56.25   1       a11 2   a11 3
21.875          56.25   28.125  43.75   1       a11 2   a11 6
28.125          43.75   21.875  31.25   1       a11 2   a11 5
21.875          31.25   0       31.25   0       a11 2   a11 1
0               56.25   0       81.25   0       a11 3   *   4
0               81.25   21.875  81.25   1       a11 3   a11 4
21.875          81.25   28.125  68.75   1       a11 3   a11 7
28.125          68.75   21.875  56.25   1       a11 3   a11 6
21.875          56.25   0       56.25   0       a11 3   a11 2
....
100             50      80      40      0       a1113   *  11
80              40      71.875  56.25   0       a1113   a11 9
71.875          56.25   78.125  68.75   0       a1113   a1110
78.125          68.75   100     68.75   1       a1113   a1114
100             68.75   100     50      0       a1113   *  12
71.875          81.25   78.125  93.75   0       a1114   a1111
78.125          93.75   100     93.75   1       a1114   a1115
100             93.75   100     68.75   0       a1114   *  13
100             68.75   78.125  68.75   0       a1114   a1113
78.125          68.75   71.875  81.25   0       a1114   a1110
100             93.75   78.125  93.75   0       a1115   a1114
78.125          93.75   71.875  106.25  0       a1115   a1111
71.875          106.25  78.125  118.75  0       a1115   a1112
78.125          118.75  100     118.75  1       a1115   a1116
100             118.75  100     93.75   0       a1115   *  14
100             150     100     118.75  0       a1116   *  15
100             118.75  78.125  118.75  0       a1116   a1115
78.125          118.75  70      135     0       a1116   a1112
70              135     100     150     0       a1116   *  16
```

Example 3.3.2 Uniform 2D grid spacing in a rhombohedron domain
Acceptance Test: Results Generated by AMESH

filename: IN

```
locat
a11 1 101     12.5000000000   18.7500000000 50.00000       10.0000
a11 2 101     12.5000000000   43.7500000000 50.00000       10.0000
a11 3 101     12.5000000000   68.7500000000 50.00000       10.0000
a11 4 101     12.5000000000   93.7500000000 50.00000       10.0000
a11 5 101     37.5000000000   31.2500000000 50.00000       10.0000
a11 6 101     37.5000000000   56.2500000000 50.00000       10.0000
a11 7 101     37.5000000000   81.2500000000 50.00000       10.0000
a11 8 101     37.5000000000  106.2500000000 50.00000       10.0000
a11 9 101     62.5000000000   43.7500000000 50.00000       10.0000
a1110 101     62.5000000000   68.7500000000 50.00000       10.0000
a1111 101     62.5000000000   93.7500000000 50.00000       10.0000
a1112 101     62.5000000000  118.7500000000 50.00000       10.0000
a1113 101     87.5000000000   56.2500000000 50.00000       10.0000
a1114 101     87.5000000000   81.2500000000 50.00000       10.0000
a1115 101     87.5000000000  106.2500000000 50.00000       10.0000
a1116 101     87.5000000000  131.2500000000 50.00000       10.0000

bound
0.0   0.0
0.0   100.0
100.0 150.0
100.0 50.0

toler
0.5
```

filename: ELEME

```
eleme
a11 1          rock1 6.465e+03                12.500      18.750      50.0000
a11 2          rock1 6.250e+03                12.500      43.750      50.0000
a11 3          rock1 6.250e+03                12.500      68.750      50.0000
a11 4          rock1 6.035e+03                12.500      93.750      50.0000
a11 5          rock1 6.250e+03                37.500      31.250      50.0000
a11 6          rock1 6.250e+03                37.500      56.250      50.0000
a11 7          rock1 6.250e+03                37.500      81.250      50.0000
a11 8          rock1 6.250e+03                37.500     106.250      50.0000
a11 9          rock1 6.250e+03                62.500      43.750      50.0000
a1110          rock1 6.250e+03                62.500      68.750      50.0000
a1111          rock1 6.250e+03                62.500      93.750      50.0000
a1112          rock1 6.250e+03                62.500     118.750      50.0000
a1113          rock1 6.035e+03                87.500      56.250      50.0000
a1114          rock1 6.250e+03                87.500      81.250      50.0000
a1115          rock1 6.250e+03                87.500     106.250      50.0000
a1116          rock1 6.465e+03                87.500     131.250      50.0000
```

filename: CONNE

```
conne
a11 1 *    1                    1 1.250e+01 0.000e+00 3.125e+02
a11 1 a11  2                    1 1.250e+01 1.250e+01 2.188e+02
a11 1 a11  5                    1 1.398e+01 1.398e+01 1.817e+02
a11 1 *    2                    1 1.118e+01 0.000e+00 3.354e+02
a11 2 *    3                    1 1.250e+01 0.000e+00 2.500e+02
a11 2 a11  3                    1 1.250e+01 1.250e+01 2.188e+02
a11 2 a11  6                    1 1.398e+01 1.398e+01 1.398e+02
a11 2 a11  5                    1 1.398e+01 1.398e+01 1.398e+02
a11 3 *    4                    1 1.250e+01 0.000e+00 2.500e+02
a11 3 a11  4                    1 1.250e+01 1.250e+01 2.188e+02
a11 3 a11  7                    1 1.398e+01 1.398e+01 1.398e+02
a11 3 a11  6                    1 1.398e+01 1.398e+01 1.398e+02
a11 4 *    5                    1 1.118e+01 0.000e+00 2.236e+02
a11 4 a11  8                    1 1.398e+01 1.398e+01 1.817e+02
a11 4 a11  7                    1 1.398e+01 1.398e+01 1.398e+02
a11 4 *    6                    1 1.250e+01 0.000e+00 1.875e+02
a11 5 a11  6                    1 1.250e+01 1.250e+01 1.875e+02
a11 5 a11  9                    1 1.398e+01 1.398e+01 1.817e+02
a11 5 *    7                    1 1.118e+01 0.000e+00 2.795e+02
a11 6 a11  7                    1 1.250e+01 1.250e+01 1.875e+02
a11 6 a1110                     1 1.398e+01 1.398e+01 1.398e+02
a11 6 a11  9                    1 1.398e+01 1.398e+01 1.398e+02
a11 7 a11  8                    1 1.250e+01 1.250e+01 1.875e+02
a11 7 a1111                     1 1.398e+01 1.398e+01 1.398e+02
a11 7 a1110                     1 1.398e+01 1.398e+01 1.398e+02
a11 8 *    8                    1 1.118e+01 0.000e+00 2.795e+02
a11 8 a1112                     1 1.398e+01 1.398e+01 1.817e+02
a11 8 a1111                     1 1.398e+01 1.398e+01 1.398e+02
a11 9 a1110                     1 1.250e+01 1.250e+01 1.875e+02
a11 9 a1113                     1 1.398e+01 1.398e+01 1.817e+02
a11 9 *    9                    1 1.118e+01 0.000e+00 2.795e+02
a1110 a1111                     1 1.250e+01 1.250e+01 1.875e+02
a1110 a1114                     1 1.398e+01 1.398e+01 1.398e+02
a1110 a1113                     1 1.398e+01 1.398e+01 1.398e+02
a1111 a1112                     1 1.250e+01 1.250e+01 1.875e+02
a1111 a1115                     1 1.398e+01 1.398e+01 1.398e+02
a1111 a1114                     1 1.398e+01 1.398e+01 1.398e+02
a1112 *   10                    1 1.118e+01 0.000e+00 2.795e+02
a1112 a1116                     1 1.398e+01 1.398e+01 1.817e+02
a1112 a1115                     1 1.398e+01 1.398e+01 1.398e+02
a1113 *   11                    1 1.118e+01 0.000e+00 2.236e+02
a1113 a1114                     1 1.250e+01 1.250e+01 2.188e+02
a1113 *   12                    1 1.250e+01 0.000e+00 1.875e+02
a1114 a1115                     1 1.250e+01 1.250e+01 2.188e+02
a1114 *   13                    1 1.250e+01 0.000e+00 2.500e+02
a1115 a1116                     1 1.250e+01 1.250e+01 2.188e+02
a1115 *   14                    1 1.250e+01 0.000e+00 2.500e+02
a1116 *   15                    1 1.250e+01 0.000e+00 3.125e+02
a1116 *   16                    1 1.118e+01 0.000e+00 3.354e+02
```

filename: SEGMT

```
0           0        0        31.25    0      a11 1   *    1
0           31.25    21.875   31.25    1      a11 1   a11 2
21.875      31.25    30       15       1      a11 1   a11 5
30          15       0        0        0      a11 1   *    2
0           31.25    0        56.25    0      a11 2   *    3
0           56.25    21.875   56.25    1      a11 2   a11 3
21.875      56.25    28.125   43.75    1      a11 2   a11 6
28.125      43.75    21.875   31.25    1      a11 2   a11 5
21.875      31.25    0        31.25    0      a11 2   a11 1
0           56.25    0        81.25    0      a11 3   *    4
0           81.25    21.875   81.25    1      a11 3   a11 4
21.875      81.25    28.125   68.75    1      a11 3   a11 7
28.125      68.75    21.875   56.25    1      a11 3   a11 6
21.875      56.25    0        56.25    0      a11 3   a11 2
0           100      20       110      0      a11 4   *    5
20          110      28.125   93.75    1      a11 4   a11 8
28.125      93.75    21.875   81.25    1      a11 4   a11 7
21.875      81.25    0        81.25    0      a11 4   a11 3
0           81.25    0        100      0      a11 4   *    6
30          15       21.875   31.25    0      a11 5   a11 1
21.875      31.25    28.125   43.75    0      a11 5   a11 2
28.125      43.75    46.875   43.75    1      a11 5   a11 6
46.875      43.75    55       27.5     1      a11 5   a11 9
55          27.5     30       15       0      a11 5   *    7
28.125      43.75    21.875   56.25    0      a11 6   a11 2
21.875      56.25    28.125   68.75    0      a11 6   a11 3
28.125      68.75    46.875   68.75    1      a11 6   a11 7
46.875      68.75    53.125   56.25    1      a11 6   a1110
53.125      56.25    46.875   43.75    1      a11 6   a11 9
46.875      43.75    28.125   43.75    0      a11 6   a11 5
28.125      68.75    21.875   81.25    0      a11 7   a11 3
21.875      81.25    28.125   93.75    0      a11 7   a11 4
28.125      93.75    46.875   93.75    1      a11 7   a11 8
46.875      93.75    53.125   81.25    1      a11 7   a1111
53.125      81.25    46.875   68.75    1      a11 7   a1110
46.875      68.75    28.125   68.75    0      a11 7   a11 6
28.125      93.75    20       110      0      a11 8   a11 4
20          110      45       122.5    0      a11 8   *    8
45          122.5    53.125   106.25   1      a11 8   a1112
53.125      106.25   46.875   93.75    1      a11 8   a1111
46.875      93.75    28.125   93.75    0      a11 8   a11 7
55          27.5     46.875   43.75    0      a11 9   a11 5
46.875      43.75    53.125   56.25    0      a11 9   a11 6
53.125      56.25    71.875   56.25    1      a11 9   a1110
71.875      56.25    80       40       1      a11 9   a1113
80          40       55       27.5     0      a11 9   *    9
46.875      68.75    53.125   81.25    0      a1110   a11 7
53.125      81.25    71.875   81.25    1      a1110   a1111
71.875      81.25    78.125   68.75    1      a1110   a1114
78.125      68.75    71.875   56.25    1      a1110   a1113
71.875      56.25    53.125   56.25    0      a1110   a11 9
53.125      56.25    46.875   68.75    0      a1110   a11 6
46.875      93.75    53.125   106.25   0      a1111   a11 8
53.125      106.25   71.875   106.25   1      a1111   a1112
71.875      106.25   78.125   93.75    1      a1111   a1115
78.125      93.75    71.875   81.25    1      a1111   a1114
71.875      81.25    53.125   81.25    0      a1111   a1110
53.125      81.25    46.875   93.75    0      a1111   a11 7
53.125      106.25   45       122.5    0      a1112   a11 8
45          122.5    70       135      0      a1112   *   10
70          135      78.125   118.75   1      a1112   a1116
78.125      118.75   71.875   106.25   1      a1112   a1115
71.875      106.25   53.125   106.25   0      a1112   a1111
100         50       80       40       0      a1113   *   11
80          40       71.875   56.25    0      a1113   a11 9
71.875      56.25    78.125   68.75    0      a1113   a1110
78.125      68.75    100      68.75    1      a1113   a1114
100         68.75    100      50       0      a1113   *   12
71.875      81.25    78.125   93.75    0      a1114   a1111
78.125      93.75    100      93.75    1      a1114   a1115
100         93.75    100      68.75    0      a1114   *   13
100         68.75    78.125   68.75    0      a1114   a1113
78.125      68.75    71.875   81.25    0      a1114   a1110
100         93.75    78.125   93.75    0      a1115   a1114
78.125      93.75    71.875   106.25   0      a1115   a1111
```

```
71.875      106.25  78.125  118.75  0       a1115   a1112
78.125      118.75  100     118.75  1       a1115   a1116
100         118.75  100     93.75   0       a1115   *  14
100         150     100     118.75  0       a1116   *  15
100         118.75  78.125  118.75  0       a1116   a1115
78.125      118.75  70      135     0       a1116   a1112
70          135     100     150     0       a1116   *  16
```

Example 3.3.3 Uniform 3D grid spacing in a rectangular domain
Test Case and Expected Output as Provided in the AMESH User's Manual

This test case and the case that follows (Example 3.3.3 and 3.3.4) share a discrepancy in the CONNE output file when compared to the expected output as indicated by the User's Manual. *isot*, as described, is the direction of the permeability factor, and according to the User's Manual the magnitude of *isot* is expected to be 3 between element pairs with a vertical association in these two examples (the inference is that *isot* is a flag, where a value of 1 corresponds to the x-direction, a value of 2 corresponds to the y-direction, and a value of 3 corresponds to the z-direction). However, when AMESH 2.0 is run from the input files given (*i.e.* IN), all of the *isot* magnitudes are 1. Upon further investigation of the software code, it was observed that the *isot* parameter in AMESH 2.0 is hardwired to a value of 1. Thus, this discrepancy is attributable to an out-of-date User's Manual, and *isot* is recognized to be nothing more than a vestigial parameter from previous versions of the software. *isot* is not used in preparing MULTIFLOW input or in any regulatory analysis.

filename: IN

```
locat
a11 1 101     12.5000000000  12.5000000000  50.00  10.00
a21 1 102     12.5000000000  12.5000000000  40.00  10.00
a31 1 103     12.5000000000  12.5000000000  30.00  10.00
a41 1 104     12.5000000000  12.5000000000  20.00  10.00
a11 2 101     12.5000000000  37.5000000000  50.00  10.00
a21 2 102     12.5000000000  37.5000000000  40.00  10.00
a31 2 103     12.5000000000  37.5000000000  30.00  10.00
a41 2 104     12.5000000000  37.5000000000  20.00  10.00
a11 3 101     12.5000000000  62.5000000000  50.00  10.00
a21 3 102     12.5000000000  62.5000000000  40.00  10.00
a31 3 103     12.5000000000  62.5000000000  30.00  10.00
a41 3 104     12.5000000000  62.5000000000  20.00  10.00
a11 4 101     12.5000000000  87.5000000000  50.00  10.00
a21 4 102     12.5000000000  87.5000000000  40.00  10.00
a31 4 103     12.5000000000  87.5000000000  30.00  10.00
a41 4 104     12.5000000000  87.5000000000  20.00  10.00
a11 5 101     37.5000000000  12.5000000000  50.00  10.00
a21 5 102     37.5000000000  12.5000000000  40.00  10.00
a31 5 103     37.5000000000  12.5000000000  30.00  10.00
a41 5 104     37.5000000000  12.5000000000  20.00  10.00
a11 6 101     37.5000000000  37.5000000000  50.00  10.00
a21 6 102     37.5000000000  37.5000000000  40.00  10.00
a31 6 103     37.5000000000  37.5000000000  30.00  10.00
a41 6 104     37.5000000000  37.5000000000  20.00  10.00
a11 7 101     37.5000000000  62.5000000000  50.00  10.00
a21 7 102     37.5000000000  62.5000000000  40.00  10.00
a31 7 103     37.5000000000  62.5000000000  30.00  10.00
a41 7 104     37.5000000000  62.5000000000  20.00  10.00
a11 8 101     37.5000000000  87.5000000000  50.00  10.00
a21 8 102     37.5000000000  87.5000000000  40.00  10.00
a31 8 103     37.5000000000  87.5000000000  30.00  10.00
a41 8 104     37.5000000000  87.5000000000  20.00  10.00
a11 9 101     62.5000000000  12.5000000000  50.00  10.00
a21 9 102     62.5000000000  12.5000000000  40.00  10.00
a31 9 103     62.5000000000  12.5000000000  30.00  10.00
a41 9 104     62.5000000000  12.5000000000  20.00  10.00
a1110 101     62.5000000000  37.5000000000  50.00  10.00
a2110 102     62.5000000000  37.5000000000  40.00  10.00
a3110 103     62.5000000000  37.5000000000  30.00  10.00
a4110 104     62.5000000000  37.5000000000  20.00  10.00
a1111 101     62.5000000000  62.5000000000  50.00  10.00
a2111 102     62.5000000000  62.5000000000  40.00  10.00
a3111 103     62.5000000000  62.5000000000  30.00  10.00
a4111 104     62.5000000000  62.5000000000  20.00  10.00
a1112 101     62.5000000000  87.5000000000  50.00  10.00
a2112 102     62.5000000000  87.5000000000  40.00  10.00
a3112 103     62.5000000000  87.5000000000  30.00  10.00
a4112 104     62.5000000000  87.5000000000  20.00  10.00
a1113 101     87.5000000000  12.5000000000  50.00  10.00
```

```
a2113  102     87.5000000000  12.5000000000  40.00   10.00
a3113  103     87.5000000000  12.5000000000  30.00   10.00
a4113  104     87.5000000000  12.5000000000  20.00   10.00
a1114  101     87.5000000000  37.5000000000  50.00   10.00
a2114  102     87.5000000000  37.5000000000  40.00   10.00
a3114  103     87.5000000000  37.5000000000  30.00   10.00
a4114  104     87.5000000000  37.5000000000  20.00   10.00
a1115  101     87.5000000000  62.5000000000  50.00   10.00
a2115  102     87.5000000000  62.5000000000  40.00   10.00
a3115  103     87.5000000000  62.5000000000  30.00   10.00
a4115  104     87.5000000000  62.5000000000  20.00   10.00
a1116  101     87.5000000000  87.5000000000  50.00   10.00
a2116  102     87.5000000000  87.5000000000  40.00   10.00
a3116  103     87.5000000000  87.5000000000  30.00   10.00
a4116  104     87.5000000000  87.5000000000  20.00   10.00

bound
0.0    0.0
0.0    100.0
100.0  100.0
100.0  0.0

toler
0.5
```

filename: ELEME

```
eleme
a11 1  rock1   6.250e+03      12.500  12.500  50.0000
a21 1  rock1   6.250e+03      12.500  12.500  40.0000
a31 1  rock1   6.250e+03      12.500  12.500  30.0000
a41 1  rock1   6.250e+03      12.500  12.500  20.0000
a11 2  rock1   6.250e+03      12.500  37.500  50.0000
a21 2  rock1   6.250e+03      12.500  37.500  40.0000
a31 2  rock1   6.250e+03      12.500  37.500  30.0000
a41 2  rock1   6.250e+03      12.500  37.500  20.0000
a11 3  rock1   6.250e+03      12.500  62.500  50.0000
a21 3  rock1   6.250e+03      12.500  62.500  40.0000
a31 3  rock1   6.250e+03      12.500  62.500  30.0000
a41 3  rock1   6.250e+03      12.500  62.500  20.0000
a11 4  rock1   6.250e+03      12.500  87.500  50.0000
a21 4  rock1   6.250e+03      12.500  87.500  40.0000
a31 4  rock1   6.250e+03      12.500  87.500  30.0000
a41 4  rock1   6.250e+03      12.500  87.500  20.0000
a11 5  rock1   6.250e+03      37.500  12.500  50.0000
a21 5  rock1   6.250e+03      37.500  12.500  40.0000
a31 5  rock1   6.250e+03      37.500  12.500  30.0000
a41 5  rock1   6.250e+03      37.500  12.500  20.0000
a11 6  rock1   6.250e+03      37.500  37.500  50.0000
a21 6  rock1   6.250e+03      37.500  37.500  40.0000
a31 6  rock1   6.250e+03      37.500  37.500  30.0000
a41 6  rock1   6.250e+03      37.500  37.500  20.0000
....
a1114  rock1   6.250e+03      87.500  37.500  50.0000
a2114  rock1   6.250e+03      87.500  37.500  40.0000
a3114  rock1   6.250e+03      87.500  37.500  30.0000
a4114  rock1   6.250e+03      87.500  37.500  20.0000
a1115  rock1   6.250e+03      87.500  62.500  50.0000
a2115  rock1   6.250e+03      87.500  62.500  40.0000
a3115  rock1   6.250e+03      87.500  62.500  30.0000
a4115  rock1   6.250e+03      87.500  62.500  20.0000
a1116  rock1   6.250e+03      87.500  87.500  50.0000
a2116  rock1   6.250e+03      87.500  87.500  40.0000
a3116  rock1   6.250e+03      87.500  87.500  30.0000
a4116  rock1   6.250e+03      87.500  87.500  20.0000
```

filename: CONNE

```
conne
a11 1  a11 2   1       1.250e+01       1.250e+01       2.500e+02       0.0
a11 1  a11 5   1       1.250e+01       1.250e+01       2.500e+02       0.0
a21 1  a21 2   1       1.250e+01       1.250e+01       2.500e+02       0.0
a21 1  a21 5   1       1.250e+01       1.250e+01       2.500e+02       0.0
a21 1  a11 1   3       5.000e+00       5.000e+00       6.250e+02       1.0
a31 1  a31 2   1       1.250e+01       1.250e+01       2.500e+02       0.0
a31 1  a31 5   1       1.250e+01       1.250e+01       2.500e+02       0.0
a31 1  a21 1   3       5.000e+00       5.000e+00       6.250e+02       1.0
a41 1  a41 2   1       1.250e+01       1.250e+01       2.500e+02       0.0
a41 1  a41 5   1       1.250e+01       1.250e+01       2.500e+02       0.0
a41 1  a31 1   3       5.000e+00       5.000e+00       6.250e+02       1.0
a11 2  a11 3   1       1.250e+01       1.250e+01       2.500e+02       0.0
a11 2  a11 6   1       1.250e+01       1.250e+01       2.500e+02       0.0
a21 2  a21 3   1       1.250e+01       1.250e+01       2.500e+02       0.0
a21 2  a21 6   1       1.250e+01       1.250e+01       2.500e+02       0.0
a21 2  a11 2   3       5.000e+00       5.000e+00       6.250e+02       1.0
a31 2  a31 3   1       1.250e+01       1.250e+01       2.500e+02       0.0
a31 2  a31 6   1       1.250e+01       1.250e+01       2.500e+02       0.0
a31 2  a21 2   3       5.000e+00       5.000e+00       6.250e+02       1.0
a41 2  a41 3   1       1.250e+01       1.250e+01       2.500e+02       0.0
a41 2  a41 6   1       1.250e+01       1.250e+01       2.500e+02       0.0
a41 2  a31 2   3       5.000e+00       5.000e+00       6.250e+02       1.0
a11 3  a11 4   1       1.250e+01       1.250e+01       2.500e+02       0.0
a11 3  a11 7   1       1.250e+01       1.250e+01       2.500e+02       0.0
a21 3  a21 4   1       1.250e+01       1.250e+01       2.500e+02       0.0
....
a3114  a3115   1       1.250e+01       1.250e+01       2.500e+02       0.0
a3114  a2114   3       5.000e+00       5.000e+00       6.250e+02       1.0
a4114  a4115   1       1.250e+01       1.250e+01       2.500e+02       0.0
a4114  a3114   3       5.000e+00       5.000e+00       6.250e+02       1.0
a1115  a1116   1       1.250e+01       1.250e+01       2.500e+02       0.0
a2115  a2116   1       1.250e+01       1.250e+01       2.500e+02       0.0
a2115  a1115   3       5.000e+00       5.000e+00       6.250e+02       1.0
a3115  a3116   1       1.250e+01       1.250e+01       2.500e+02       0.0
a3115  a2115   3       5.000e+00       5.000e+00       6.250e+02       1.0
a4115  a4116   1       1.250e+01       1.250e+01       2.500e+02       0.0
a4115  a3115   3       5.000e+00       5.000e+00       6.250e+02       1.0
a2116  a1116   3       5.000e+00       5.000e+00       6.250e+02       1.0
a3116  a2116   3       5.000e+00       5.000e+00       6.250e+02       1.0
a4116  a3116   3       5.000e+00       5.000e+00       6.250e+02       1.0
```

filename: SEGMT

```
0     0     0     25    0     a11 1  *   1
0     25    25    25    1     a11 1  a11 2
25    25    25    0     1     a11 1  a11 5
25    0     0     0     0     a11 1  *   2
0     0     0     25    0     a21 1  *   3
0     25    25    25    1     a21 1  a21 2
25    25    25    0     1     a21 1  a21 5
25    0     0     0     0     a21 1  *   4
0     0     0     25    0     a31 1  *   5
0     25    25    25    1     a31 1  a31 2
25    25    25    0     1     a31 1  a31 5
25    0     0     0     0     a31 1  *   6
0     0     0     25    0     a41 1  *   7
0     25    25    25    1     a41 1  a41 2
25    25    25    0     1     a41 1  a41 5
25    0     0     0     0     a41 1  *   8
0     25    0     50    0     a11 2  *   9
0     50    25    50    1     a11 2  a11 3
25    50    25    25    1     a11 2  a11 6
....
75    50    75    75    0     a4115  a4111
75    75    100   75    1     a4115  a4116
100   75    100   50    0     a4115  *  56
100   100   100   75    0     a1116  *  57
100   75    75    75    0     a1116  a1115
75    75    75    100   0     a1116  a1112
75    100   100   100   0     a1116  *  58
100   100   100   75    0     a2116  *  59
100   75    75    75    0     a2116  a2115
75    75    75    100   0     a2116  a2112
75    100   100   100   0     a2116  *  60
100   100   100   75    0     a3116  *  61
100   75    75    75    0     a3116  a3115
75    75    75    100   0     a3116  a3112
75    100   100   100   0     a3116  *  62
100   100   100   75    0     a4116  *  63
100   75    75    75    0     a4116  a4115
75    75    75    100   0     a4116  a4112
75    100   100   100   0     a4116  *  64
```

Example 3.3.3 Uniform 3D grid spacing in a rectangular domain
Acceptance Test: Results Generated by AMESH

filename: IN

```
locat
a11 1 101     12.5000000000  12.5000000000  50.00   10.00
a21 1 102     12.5000000000  12.5000000000  40.00   10.00
a31 1 103     12.5000000000  12.5000000000  30.00   10.00
a41 1 104     12.5000000000  12.5000000000  20.00   10.00
a11 2 101     12.5000000000  37.5000000000  50.00   10.00
a21 2 102     12.5000000000  37.5000000000  40.00   10.00
a31 2 103     12.5000000000  37.5000000000  30.00   10.00
a41 2 104     12.5000000000  37.5000000000  20.00   10.00
a11 3 101     12.5000000000  62.5000000000  50.00   10.00
a21 3 102     12.5000000000  62.5000000000  40.00   10.00
a31 3 103     12.5000000000  62.5000000000  30.00   10.00
a41 3 104     12.5000000000  62.5000000000  20.00   10.00
a11 4 101     12.5000000000  87.5000000000  50.00   10.00
a21 4 102     12.5000000000  87.5000000000  40.00   10.00
a31 4 103     12.5000000000  87.5000000000  30.00   10.00
a41 4 104     12.5000000000  87.5000000000  20.00   10.00
a11 5 101     37.5000000000  12.5000000000  50.00   10.00
a21 5 102     37.5000000000  12.5000000000  40.00   10.00
a31 5 103     37.5000000000  12.5000000000  30.00   10.00
a41 5 104     37.5000000000  12.5000000000  20.00   10.00
a11 6 101     37.5000000000  37.5000000000  50.00   10.00
a21 6 102     37.5000000000  37.5000000000  40.00   10.00
a31 6 103     37.5000000000  37.5000000000  30.00   10.00
a41 6 104     37.5000000000  37.5000000000  20.00   10.00
a11 7 101     37.5000000000  62.5000000000  50.00   10.00
a21 7 102     37.5000000000  62.5000000000  40.00   10.00
a31 7 103     37.5000000000  62.5000000000  30.00   10.00
a41 7 104     37.5000000000  62.5000000000  20.00   10.00
a11 8 101     37.5000000000  87.5000000000  50.00   10.00
a21 8 102     37.5000000000  87.5000000000  40.00   10.00
a31 8 103     37.5000000000  87.5000000000  30.00   10.00
a41 8 104     37.5000000000  87.5000000000  20.00   10.00
a11 9 101     62.5000000000  12.5000000000  50.00   10.00
a21 9 102     62.5000000000  12.5000000000  40.00   10.00
a31 9 103     62.5000000000  12.5000000000  30.00   10.00
a41 9 104     62.5000000000  12.5000000000  20.00   10.00
a1110 101     62.5000000000  37.5000000000  50.00   10.00
a2110 102     62.5000000000  37.5000000000  40.00   10.00
a3110 103     62.5000000000  37.5000000000  30.00   10.00
a4110 104     62.5000000000  37.5000000000  20.00   10.00
a1111 101     62.5000000000  62.5000000000  50.00   10.00
a2111 102     62.5000000000  62.5000000000  40.00   10.00
a3111 103     62.5000000000  62.5000000000  30.00   10.00
a4111 104     62.5000000000  62.5000000000  20.00   10.00
a1112 101     62.5000000000  87.5000000000  50.00   10.00
a2112 102     62.5000000000  87.5000000000  40.00   10.00
a3112 103     62.5000000000  87.5000000000  30.00   10.00
a4112 104     62.5000000000  87.5000000000  20.00   10.00
a1113 101     87.5000000000  12.5000000000  50.00   10.00
a2113 102     87.5000000000  12.5000000000  40.00   10.00
a3113 103     87.5000000000  12.5000000000  30.00   10.00
a4113 104     87.5000000000  12.5000000000  20.00   10.00
a1114 101     87.5000000000  37.5000000000  50.00   10.00
a2114 102     87.5000000000  37.5000000000  40.00   10.00
a3114 103     87.5000000000  37.5000000000  30.00   10.00
a4114 104     87.5000000000  37.5000000000  20.00   10.00
a1115 101     87.5000000000  62.5000000000  50.00   10.00
a2115 102     87.5000000000  62.5000000000  40.00   10.00
a3115 103     87.5000000000  62.5000000000  30.00   10.00
a4115 104     87.5000000000  62.5000000000  20.00   10.00
a1116 101     87.5000000000  87.5000000000  50.00   10.00
a2116 102     87.5000000000  87.5000000000  40.00   10.00
a3116 103     87.5000000000  87.5000000000  30.00   10.00
a4116 104     87.5000000000  87.5000000000  20.00   10.00
```

```
bound
0.0   0.0
0.0   100.0
100.0 100.0
100.0 0.0

toler
0.5
```

filename: ELEME

```
eleme
a11 1          rock1 6.250e+03          12.500      12.500      50.0000
a21 1          rock1 6.250e+03          12.500      12.500      40.0000
a31 1          rock1 6.250e+03          12.500      12.500      30.0000
a41 1          rock1 6.250e+03          12.500      12.500      20.0000
a11 2          rock1 6.250e+03          12.500      37.500      50.0000
a21 2          rock1 6.250e+03          12.500      37.500      40.0000
a31 2          rock1 6.250e+03          12.500      37.500      30.0000
a41 2          rock1 6.250e+03          12.500      37.500      20.0000
a11 3          rock1 6.250e+03          12.500      62.500      50.0000
a21 3          rock1 6.250e+03          12.500      62.500      40.0000
a31 3          rock1 6.250e+03          12.500      62.500      30.0000
a41 3          rock1 6.250e+03          12.500      62.500      20.0000
a11 4          rock1 6.250e+03          12.500      87.500      50.0000
a21 4          rock1 6.250e+03          12.500      87.500      40.0000
a31 4          rock1 6.250e+03          12.500      87.500      30.0000
a41 4          rock1 6.250e+03          12.500      87.500      20.0000
a11 5          rock1 6.250e+03          37.500      12.500      50.0000
a21 5          rock1 6.250e+03          37.500      12.500      40.0000
a31 5          rock1 6.250e+03          37.500      12.500      30.0000
a41 5          rock1 6.250e+03          37.500      12.500      20.0000
a11 6          rock1 6.250e+03          37.500      37.500      50.0000
a21 6          rock1 6.250e+03          37.500      37.500      40.0000
a31 6          rock1 6.250e+03          37.500      37.500      30.0000
a41 6          rock1 6.250e+03          37.500      37.500      20.0000
a11 7          rock1 6.250e+03          37.500      62.500      50.0000
a21 7          rock1 6.250e+03          37.500      62.500      40.0000
a31 7          rock1 6.250e+03          37.500      62.500      30.0000
a41 7          rock1 6.250e+03          37.500      62.500      20.0000
a11 8          rock1 6.250e+03          37.500      87.500      50.0000
a21 8          rock1 6.250e+03          37.500      87.500      40.0000
a31 8          rock1 6.250e+03          37.500      87.500      30.0000
a41 8          rock1 6.250e+03          37.500      87.500      20.0000
a11 9          rock1 6.250e+03          62.500      12.500      50.0000
a21 9          rock1 6.250e+03          62.500      12.500      40.0000
a31 9          rock1 6.250e+03          62.500      12.500      30.0000
a41 9          rock1 6.250e+03          62.500      12.500      20.0000
a1110          rock1 6.250e+03          62.500      37.500      50.0000
a2110          rock1 6.250e+03          62.500      37.500      40.0000
a3110          rock1 6.250e+03          62.500      37.500      30.0000
a4110          rock1 6.250e+03          62.500      37.500      20.0000
a1111          rock1 6.250e+03          62.500      62.500      50.0000
a2111          rock1 6.250e+03          62.500      62.500      40.0000
a3111          rock1 6.250e+03          62.500      62.500      30.0000
a4111          rock1 6.250e+03          62.500      62.500      20.0000
a1112          rock1 6.250e+03          62.500      87.500      50.0000
a2112          rock1 6.250e+03          62.500      87.500      40.0000
a3112          rock1 6.250e+03          62.500      87.500      30.0000
a4112          rock1 6.250e+03          62.500      87.500      20.0000
a1113          rock1 6.250e+03          87.500      12.500      50.0000
a2113          rock1 6.250e+03          87.500      12.500      40.0000
a3113          rock1 6.250e+03          87.500      12.500      30.0000
a4113          rock1 6.250e+03          87.500      12.500      20.0000
a1114          rock1 6.250e+03          87.500      37.500      50.0000
a2114          rock1 6.250e+03          87.500      37.500      40.0000
a3114          rock1 6.250e+03          87.500      37.500      30.0000
a4114          rock1 6.250e+03          87.500      37.500      20.0000
a1115          rock1 6.250e+03          87.500      62.500      50.0000
a2115          rock1 6.250e+03          87.500      62.500      40.0000
a3115          rock1 6.250e+03          87.500      62.500      30.0000
a4115          rock1 6.250e+03          87.500      62.500      20.0000
a1116          rock1 6.250e+03          87.500      87.500      50.0000
a2116          rock1 6.250e+03          87.500      87.500      40.0000
a3116          rock1 6.250e+03          87.500      87.500      30.0000
a4116          rock1 6.250e+03          87.500      87.500      20.0000
```

filename: CONNE

```
conne
a11 1 *   1                    1 1.250e+01 0.000e+00 2.500e+02
a11 1 a11 2                    1 1.250e+01 1.250e+01 2.500e+02
a11 1 a11 5                    1 1.250e+01 1.250e+01 2.500e+02
a11 1 *   2                    1 1.250e+01 0.000e+00 2.500e+02
a21 1 *   3                    1 1.250e+01 0.000e+00 2.500e+02
a21 1 a21 2                    1 1.250e+01 1.250e+01 2.500e+02
a21 1 a21 5                    1 1.250e+01 1.250e+01 2.500e+02
a21 1 *   4                    1 1.250e+01 0.000e+00 2.500e+02
a21 1 a11 1                    1 5.000e+00 5.000e+00 6.250e+02 1.
a31 1 *   5                    1 1.250e+01 0.000e+00 2.500e+02
a31 1 a31 2                    1 1.250e+01 1.250e+01 2.500e+02
a31 1 a31 5                    1 1.250e+01 1.250e+01 2.500e+02
a31 1 *   6                    1 1.250e+01 0.000e+00 2.500e+02
a31 1 a21 1                    1 5.000e+00 5.000e+00 6.250e+02 1.
a41 1 *   7                    1 1.250e+01 0.000e+00 2.500e+02
a41 1 a41 2                    1 1.250e+01 1.250e+01 2.500e+02
a41 1 a41 5                    1 1.250e+01 1.250e+01 2.500e+02
a41 1 *   8                    1 1.250e+01 0.000e+00 2.500e+02
a41 1 a31 1                    1 5.000e+00 5.000e+00 6.250e+02 1.
a11 2 *   9                    1 1.250e+01 0.000e+00 2.500e+02
a11 2 a11 3                    1 1.250e+01 1.250e+01 2.500e+02
a11 2 a11 6                    1 1.250e+01 1.250e+01 2.500e+02
a21 2 *  10                    1 1.250e+01 0.000e+00 2.500e+02
a21 2 a21 3                    1 1.250e+01 1.250e+01 2.500e+02
a21 2 a21 6                    1 1.250e+01 1.250e+01 2.500e+02
a21 2 a11 2                    1 5.000e+00 5.000e+00 6.250e+02 1.
a31 2 *  11                    1 1.250e+01 0.000e+00 2.500e+02
a31 2 a31 3                    1 1.250e+01 1.250e+01 2.500e+02
a31 2 a31 6                    1 1.250e+01 1.250e+01 2.500e+02
a31 2 a21 2                    1 5.000e+00 5.000e+00 6.250e+02 1.
a41 2 *  12                    1 1.250e+01 0.000e+00 2.500e+02
a41 2 a41 3                    1 1.250e+01 1.250e+01 2.500e+02
a41 2 a41 6                    1 1.250e+01 1.250e+01 2.500e+02
a41 2 a31 2                    1 5.000e+00 5.000e+00 6.250e+02 1.
a11 3 *  13                    1 1.250e+01 0.000e+00 2.500e+02
a11 3 a11 4                    1 1.250e+01 1.250e+01 2.500e+02
a11 3 a11 7                    1 1.250e+01 1.250e+01 2.500e+02
a21 3 *  14                    1 1.250e+01 0.000e+00 2.500e+02
a21 3 a21 4                    1 1.250e+01 1.250e+01 2.500e+02
a21 3 a21 7                    1 1.250e+01 1.250e+01 2.500e+02
a21 3 a11 3                    1 5.000e+00 5.000e+00 6.250e+02 1.
a31 3 *  15                    1 1.250e+01 0.000e+00 2.500e+02
a31 3 a31 4                    1 1.250e+01 1.250e+01 2.500e+02
a31 3 a31 7                    1 1.250e+01 1.250e+01 2.500e+02
a31 3 a21 3                    1 5.000e+00 5.000e+00 6.250e+02 1.
a41 3 *  16                    1 1.250e+01 0.000e+00 2.500e+02
a41 3 a41 4                    1 1.250e+01 1.250e+01 2.500e+02
a41 3 a41 7                    1 1.250e+01 1.250e+01 2.500e+02
a41 3 a31 3                    1 5.000e+00 5.000e+00 6.250e+02 1.
a11 4 *  17                    1 1.250e+01 0.000e+00 2.500e+02
a11 4 a11 8                    1 1.250e+01 1.250e+01 2.500e+02
a11 4 *  18                    1 1.250e+01 0.000e+00 2.500e+02
a21 4 *  19                    1 1.250e+01 0.000e+00 2.500e+02
a21 4 a21 8                    1 1.250e+01 1.250e+01 2.500e+02
a21 4 *  20                    1 1.250e+01 0.000e+00 2.500e+02
a21 4 a11 4                    1 5.000e+00 5.000e+00 6.250e+02 1.
a31 4 *  21                    1 1.250e+01 0.000e+00 2.500e+02
a31 4 a31 8                    1 1.250e+01 1.250e+01 2.500e+02
a31 4 *  22                    1 1.250e+01 0.000e+00 2.500e+02
a31 4 a21 4                    1 5.000e+00 5.000e+00 6.250e+02 1.
a41 4 *  23                    1 1.250e+01 0.000e+00 2.500e+02
a41 4 a41 8                    1 1.250e+01 1.250e+01 2.500e+02
a41 4 *  24                    1 1.250e+01 0.000e+00 2.500e+02
a41 4 a31 4                    1 5.000e+00 5.000e+00 6.250e+02 1.
a11 5 a11 6                    1 1.250e+01 1.250e+01 2.500e+02
a11 5 a11 9                    1 1.250e+01 1.250e+01 2.500e+02
a11 5 *  25                    1 1.250e+01 0.000e+00 2.500e+02
a21 5 a21 6                    1 1.250e+01 1.250e+01 2.500e+02
a21 5 a21 9                    1 1.250e+01 1.250e+01 2.500e+02
a21 5 *  26                    1 1.250e+01 0.000e+00 2.500e+02
a21 5 a11 5                    1 5.000e+00 5.000e+00 6.250e+02 1.
a31 5 a31 6                    1 1.250e+01 1.250e+01 2.500e+02
a31 5 a31 9                    1 1.250e+01 1.250e+01 2.500e+02
a31 5 *  27                    1 1.250e+01 0.000e+00 2.500e+02
```

```
a31 5 a21 5                1 5.000e+00 5.000e+00 6.250e+02 1.
a41 5 a41 6                1 1.250e+01 1.250e+01 2.500e+02
a41 5 a41 9                1 1.250e+01 1.250e+01 2.500e+02
a41 5 *  28               1 1.250e+01 0.000e+00 2.500e+02
a41 5 a31 5                1 5.000e+00 5.000e+00 6.250e+02 1.
a11 6 a11 7                1 1.250e+01 1.250e+01 2.500e+02
a11 6 a1110                1 1.250e+01 1.250e+01 2.500e+02
a21 6 a21 7                1 1.250e+01 1.250e+01 2.500e+02
a21 6 a2110                1 1.250e+01 1.250e+01 2.500e+02
a21 6 a11 6                1 5.000e+00 5.000e+00 6.250e+02 1.
a31 6 a31 7                1 1.250e+01 1.250e+01 2.500e+02
a31 6 a3110                1 1.250e+01 1.250e+01 2.500e+02
a31 6 a21 6                1 5.000e+00 5.000e+00 6.250e+02 1.
a41 6 a41 7                1 1.250e+01 1.250e+01 2.500e+02
a41 6 a4110                1 1.250e+01 1.250e+01 2.500e+02
a41 6 a31 6                1 5.000e+00 5.000e+00 6.250e+02 1.
a11 7 a11 8                1 1.250e+01 1.250e+01 2.500e+02
a11 7 a1111                1 1.250e+01 1.250e+01 2.500e+02
a21 7 a21 8                1 1.250e+01 1.250e+01 2.500e+02
a21 7 a2111                1 1.250e+01 1.250e+01 2.500e+02
a21 7 a11 7                1 5.000e+00 5.000e+00 6.250e+02 1.
a31 7 a31 8                1 1.250e+01 1.250e+01 2.500e+02
a31 7 a3111                1 1.250e+01 1.250e+01 2.500e+02
a31 7 a21 7                1 5.000e+00 5.000e+00 6.250e+02 1.
a41 7 a41 8                1 1.250e+01 1.250e+01 2.500e+02
a41 7 a4111                1 1.250e+01 1.250e+01 2.500e+02
a41 7 a31 7                1 5.000e+00 5.000e+00 6.250e+02 1.
a11 8 *  29               1 1.250e+01 0.000e+00 2.500e+02
a11 8 a1112                1 1.250e+01 1.250e+01 2.500e+02
a21 8 *  30               1 1.250e+01 0.000e+00 2.500e+02
a21 8 a2112                1 1.250e+01 1.250e+01 2.500e+02
a21 8 a11 8                1 5.000e+00 5.000e+00 6.250e+02 1.
a31 8 *  31               1 1.250e+01 0.000e+00 2.500e+02
a31 8 a3112                1 1.250e+01 1.250e+01 2.500e+02
a31 8 a21 8                1 5.000e+00 5.000e+00 6.250e+02 1.
a41 8 *  32               1 1.250e+01 0.000e+00 2.500e+02
a41 8 a4112                1 1.250e+01 1.250e+01 2.500e+02
a41 8 a31 8                1 5.000e+00 5.000e+00 6.250e+02 1.
a11 9 a1110                1 1.250e+01 1.250e+01 2.500e+02
a11 9 a1113                1 1.250e+01 1.250e+01 2.500e+02
a11 9 *  33               1 1.250e+01 0.000e+00 2.500e+02
a21 9 a2110                1 1.250e+01 1.250e+01 2.500e+02
a21 9 a2113                1 1.250e+01 1.250e+01 2.500e+02
a21 9 *  34               1 1.250e+01 0.000e+00 2.500e+02
a21 9 a11 9                1 5.000e+00 5.000e+00 6.250e+02 1.
a31 9 a3110                1 1.250e+01 1.250e+01 2.500e+02
a31 9 a3113                1 1.250e+01 1.250e+01 2.500e+02
a31 9 *  35               1 1.250e+01 0.000e+00 2.500e+02
a31 9 a21 9                1 5.000e+00 5.000e+00 6.250e+02 1.
a41 9 a4110                1 1.250e+01 1.250e+01 2.500e+02
a41 9 a4113                1 1.250e+01 1.250e+01 2.500e+02
a41 9 *  36               1 1.250e+01 0.000e+00 2.500e+02
a41 9 a31 9                1 5.000e+00 5.000e+00 6.250e+02 1.
a1110 a1111                1 1.250e+01 1.250e+01 2.500e+02
a1110 a1114                1 1.250e+01 1.250e+01 2.500e+02
a2110 a2111                1 1.250e+01 1.250e+01 2.500e+02
a2110 a2114                1 1.250e+01 1.250e+01 2.500e+02
a2110 a1110                1 5.000e+00 5.000e+00 6.250e+02 1.
a3110 a3111                1 1.250e+01 1.250e+01 2.500e+02
a3110 a3114                1 1.250e+01 1.250e+01 2.500e+02
a3110 a2110                1 5.000e+00 5.000e+00 6.250e+02 1.
a4110 a4111                1 1.250e+01 1.250e+01 2.500e+02
a4110 a4114                1 1.250e+01 1.250e+01 2.500e+02
a4110 a3110                1 5.000e+00 5.000e+00 6.250e+02 1.
a1111 a1112                1 1.250e+01 1.250e+01 2.500e+02
a1111 a1115                1 1.250e+01 1.250e+01 2.500e+02
a2111 a2112                1 1.250e+01 1.250e+01 2.500e+02
a2111 a2115                1 1.250e+01 1.250e+01 2.500e+02
a2111 a1111                1 5.000e+00 5.000e+00 6.250e+02 1.
a3111 a3112                1 1.250e+01 1.250e+01 2.500e+02
a3111 a3115                1 1.250e+01 1.250e+01 2.500e+02
a3111 a2111                1 5.000e+00 5.000e+00 6.250e+02 1.
a4111 a4112                1 1.250e+01 1.250e+01 2.500e+02
```

```
a4111 a4115                1 1.250e+01 1.250e+01 2.500e+02
a4111 a3111                1 5.000e+00 5.000e+00 6.250e+02 1.
a1112 *  37                1 1.250e+01 0.000e+00 2.500e+02
a1112 a1116                1 1.250e+01 1.250e+01 2.500e+02
a2112 *  38                1 1.250e+01 0.000e+00 2.500e+02
a2112 a2116                1 1.250e+01 1.250e+01 2.500e+02
a2112 a1112                1 5.000e+00 5.000e+00 6.250e+02 1.
a3112 *  39                1 1.250e+01 0.000e+00 2.500e+02
a3112 a3116                1 1.250e+01 1.250e+01 2.500e+02
a3112 a2112                1 5.000e+00 5.000e+00 6.250e+02 1.
a4112 *  40                1 1.250e+01 0.000e+00 2.500e+02
a4112 a4116                1 1.250e+01 1.250e+01 2.500e+02
a4112 a3112                1 5.000e+00 5.000e+00 6.250e+02 1.
a1113 *  41                1 1.250e+01 0.000e+00 2.500e+02
a1113 a1114                1 1.250e+01 1.250e+01 2.500e+02
a1113 *  42                1 1.250e+01 0.000e+00 2.500e+02
a2113 *  43                1 1.250e+01 0.000e+00 2.500e+02
a2113 a2114                1 1.250e+01 1.250e+01 2.500e+02
a2113 *  44                1 1.250e+01 0.000e+00 2.500e+02
a2113 a1113                1 5.000e+00 5.000e+00 6.250e+02 1.
a3113 *  45                1 1.250e+01 0.000e+00 2.500e+02
a3113 a3114                1 1.250e+01 1.250e+01 2.500e+02
a3113 *  46                1 1.250e+01 0.000e+00 2.500e+02
a3113 a2113                1 5.000e+00 5.000e+00 6.250e+02 1.
a4113 *  47                1 1.250e+01 0.000e+00 2.500e+02
a4113 a4114                1 1.250e+01 1.250e+01 2.500e+02
a4113 *  48                1 1.250e+01 0.000e+00 2.500e+02
a4113 a3113                1 5.000e+00 5.000e+00 6.250e+02 1.
a1114 a1115                1 1.250e+01 1.250e+01 2.500e+02
a1114 *  49                1 1.250e+01 0.000e+00 2.500e+02
a2114 a2115                1 1.250e+01 1.250e+01 2.500e+02
a2114 *  50                1 1.250e+01 0.000e+00 2.500e+02
a2114 a1114                1 5.000e+00 5.000e+00 6.250e+02 1.
a3114 a3115                1 1.250e+01 1.250e+01 2.500e+02
a3114 *  51                1 1.250e+01 0.000e+00 2.500e+02
a3114 a2114                1 5.000e+00 5.000e+00 6.250e+02 1.
a4114 a4115                1 1.250e+01 1.250e+01 2.500e+02
a4114 *  52                1 1.250e+01 0.000e+00 2.500e+02
a4114 a3114                1 5.000e+00 5.000e+00 6.250e+02 1.
a1115 a1116                1 1.250e+01 1.250e+01 2.500e+02
a1115 *  53                1 1.250e+01 0.000e+00 2.500e+02
a2115 a2116                1 1.250e+01 1.250e+01 2.500e+02
a2115 *  54                1 1.250e+01 0.000e+00 2.500e+02
a2115 a1115                1 5.000e+00 5.000e+00 6.250e+02 1.
a3115 a3116                1 1.250e+01 1.250e+01 2.500e+02
a3115 *  55                1 1.250e+01 0.000e+00 2.500e+02
a3115 a2115                1 5.000e+00 5.000e+00 6.250e+02 1.
a4115 a4116                1 1.250e+01 1.250e+01 2.500e+02
a4115 *  56                1 1.250e+01 0.000e+00 2.500e+02
a4115 a3115                1 5.000e+00 5.000e+00 6.250e+02 1.
a1116 *  57                1 1.250e+01 0.000e+00 2.500e+02
a1116 *  58                1 1.250e+01 0.000e+00 2.500e+02
a2116 *  59                1 1.250e+01 0.000e+00 2.500e+02
a2116 *  60                1 1.250e+01 0.000e+00 2.500e+02
a2116 a1116                1 5.000e+00 5.000e+00 6.250e+02 1.
a3116 *  61                1 1.250e+01 0.000e+00 2.500e+02
a3116 *  62                1 1.250e+01 0.000e+00 2.500e+02
a3116 a2116                1 5.000e+00 5.000e+00 6.250e+02 1.
a4116 *  63                1 1.250e+01 0.000e+00 2.500e+02
a4116 *  64                1 1.250e+01 0.000e+00 2.500e+02
a4116 a3116                1 5.000e+00 5.000e+00 6.250e+02 1.
```

filename: SEGMT

```
0     0     0     25    0     a11 1  *   1
0     25    25    25    1     a11 1  a11 2
25    25    25    0     1     a11 1  a11 5
25    0     0     0     0     a11 1  *   2
0     0     0     25    0     a21 1  *   3
0     25    25    25    1     a21 1  a21 2
25    25    25    0     1     a21 1  a21 5
25    0     0     0     0     a21 1  *   4
0     0     0     25    0     a31 1  *   5
0     25    25    25    1     a31 1  a31 2
25    25    25    0     1     a31 1  a31 5
25    0     0     0     0     a31 1  *   6
0     0     0     25    0     a41 1  *   7
0     25    25    25    1     a41 1  a41 2
25    25    25    0     1     a41 1  a41 5
25    0     0     0     0     a41 1  *   8
0     25    0     50    0     a11 2  *   9
0     50    25    50    1     a11 2  a11 3
25    50    25    25    1     a11 2  a11 6
25    25    0     25    0     a11 2  a11 1
0     25    0     50    0     a21 2  *  10
0     50    25    50    1     a21 2  a21 3
25    50    25    25    1     a21 2  a21 6
25    25    0     25    0     a21 2  a21 1
0     25    0     50    0     a31 2  *  11
0     50    25    50    1     a31 2  a31 3
25    50    25    25    1     a31 2  a31 6
25    25    0     25    0     a31 2  a31 1
0     25    0     50    0     a41 2  *  12
0     50    25    50    1     a41 2  a41 3
25    50    25    25    1     a41 2  a41 6
25    25    0     25    0     a41 2  a41 1
0     50    0     75    0     a11 3  *  13
0     75    25    75    1     a11 3  a11 4
25    75    25    50    1     a11 3  a11 7
25    50    0     50    0     a11 3  a11 2
0     50    0     75    0     a21 3  *  14
0     75    25    75    1     a21 3  a21 4
25    75    25    50    1     a21 3  a21 7
25    50    0     50    0     a21 3  a21 2
0     50    0     75    0     a31 3  *  15
0     75    25    75    1     a31 3  a31 4
25    75    25    50    1     a31 3  a31 7
25    50    0     50    0     a31 3  a31 2
0     50    0     75    0     a41 3  *  16
0     75    25    75    1     a41 3  a41 4
25    75    25    50    1     a41 3  a41 7
25    50    0     50    0     a41 3  a41 2
0     100   25    100   0     a11 4  *  17
25    100   25    75    1     a11 4  a11 8
25    75    0     75    0     a11 4  a11 3
0     75    0     100   0     a11 4  *  18
0     100   25    100   0     a21 4  *  19
25    100   25    75    1     a21 4  a21 8
25    75    0     75    0     a21 4  a21 3
0     75    0     100   0     a21 4  *  20
0     100   25    100   0     a31 4  *  21
25    100   25    75    1     a31 4  a31 8
25    75    0     75    0     a31 4  a31 3
0     75    0     100   0     a31 4  *  22
0     100   25    100   0     a41 4  *  23
25    100   25    75    1     a41 4  a41 8
25    75    0     75    0     a41 4  a41 3
0     75    0     100   0     a41 4  *  24
25    0     25    25    0     a11 5  a11 1
25    25    50    25    1     a11 5  a11 6
50    25    50    0     1     a11 5  a11 9
50    0     25    0     0     a11 5  *  25
25    0     25    25    0     a21 5  a21 1
25    25    50    25    1     a21 5  a21 6
50    25    50    0     1     a21 5  a21 9
50    0     25    0     0     a21 5  *  26
25    0     25    25    0     a31 5  a31 1
25    25    50    25    1     a31 5  a31 6
50    25    50    0     1     a31 5  a31 9
```

50	0	25	0	0	a31 5	* 27
25	0	25	25	0	a41 5	a41 1
25	25	50	25	1	a41 5	a41 6
50	25	50	0	1	a41 5	a41 9
50	0	25	0	0	a41 5	* 28
25	25	25	50	0	a11 6	a11 2
25	50	50	50	1	a11 6	a11 7
50	50	50	25	1	a11 6	a1110
50	25	25	25	0	a11 6	a11 5
25	25	25	50	0	a21 6	a21 2
25	50	50	50	1	a21 6	a21 7
50	50	50	25	1	a21 6	a2110
50	25	25	25	0	a21 6	a21 5
25	25	25	50	0	a31 6	a31 2
25	50	50	50	1	a31 6	a31 7
50	50	50	25	1	a31 6	a3110
50	25	25	25	0	a31 6	a31 5
25	25	25	50	0	a41 6	a41 2
25	50	50	50	1	a41 6	a41 7
50	50	50	25	1	a41 6	a4110
50	25	25	25	0	a41 6	a41 5
25	50	25	75	0	a11 7	a11 3
25	75	50	75	1	a11 7	a11 8
50	75	50	50	1	a11 7	a1111
50	50	25	50	0	a11 7	a11 6
25	50	25	75	0	a21 7	a21 3
25	75	50	75	1	a21 7	a21 8
50	75	50	50	1	a21 7	a2111
50	50	25	50	0	a21 7	a21 6
25	50	25	75	0	a31 7	a31 3
25	75	50	75	1	a31 7	a31 8
50	75	50	50	1	a31 7	a3111
50	50	25	50	0	a31 7	a31 6
25	50	25	75	0	a41 7	a41 3
25	75	50	75	1	a41 7	a41 8
50	75	50	50	1	a41 7	a4111
50	50	25	50	0	a41 7	a41 6
25	75	25	100	0	a11 8	a11 4
25	100	50	100	0	a11 8	* 29
50	100	50	75	1	a11 8	a1112
50	75	25	75	0	a11 8	a11 7
25	75	25	100	0	a21 8	a21 4
25	100	50	100	0	a21 8	* 30
50	100	50	75	1	a21 8	a2112
50	75	25	75	0	a21 8	a21 7
25	75	25	100	0	a31 8	a31 4
25	100	50	100	0	a31 8	* 31
50	100	50	75	1	a31 8	a3112
50	75	25	75	0	a31 8	a31 7
25	75	25	100	0	a41 8	a41 4
25	100	50	100	0	a41 8	* 32
50	100	50	75	1	a41 8	a4112
50	75	25	75	0	a41 8	a41 7
50	0	50	25	0	a11 9	a11 5
50	25	75	25	1	a11 9	a1110
75	25	75	0	1	a11 9	a1113
75	0	50	0	0	a11 9	* 33
50	0	50	25	0	a21 9	a21 5
50	25	75	25	1	a21 9	a2110
75	25	75	0	1	a21 9	a2113
75	0	50	0	0	a21 9	* 34
50	0	50	25	0	a31 9	a31 5
50	25	75	25	1	a31 9	a3110
75	25	75	0	1	a31 9	a3113
75	0	50	0	0	a31 9	* 35
50	0	50	25	0	a41 9	a41 5
50	25	75	25	1	a41 9	a4110
75	25	75	0	1	a41 9	a4113
75	0	50	0	0	a41 9	* 36
50	25	50	50	0	a1110	a11 6
50	50	75	50	1	a1110	a1111
75	50	75	25	1	a1110	a1114
75	25	50	25	0	a1110	a11 9

50	25	50	50	0	a2110	a21 6
50	50	75	50	1	a2110	a2111
75	50	75	25	1	a2110	a2114
75	25	50	25	0	a2110	a21 9
50	25	50	50	0	a3110	a31 6
50	50	75	50	1	a3110	a3111
75	50	75	25	1	a3110	a3114
75	25	50	25	0	a3110	a31 9
50	25	50	50	0	a4110	a41 6
50	50	75	50	1	a4110	a4111
75	50	75	25	1	a4110	a4114
75	25	50	25	0	a4110	a41 9
50	50	50	75	0	a1111	a11 7
50	75	75	75	1	a1111	a1112
75	75	75	50	1	a1111	a1115
75	50	50	50	0	a1111	a1110
50	50	50	75	0	a2111	a21 7
50	75	75	75	1	a2111	a2112
75	75	75	50	1	a2111	a2115
75	50	50	50	0	a2111	a2110
50	50	50	75	0	a3111	a31 7
50	75	75	75	1	a3111	a3112
75	75	75	50	1	a3111	a3115
75	50	50	50	0	a3111	a3110
50	50	50	75	0	a4111	a41 7
50	75	75	75	1	a4111	a4112
75	75	75	50	1	a4111	a4115
75	50	50	50	0	a4111	a4110
75	75	50	75	0	a1112	a1111
50	75	50	100	0	a1112	a11 8
50	100	75	100	0	a1112	* 37
75	100	75	75	1	a1112	a1116
75	75	50	75	0	a2112	a2111
50	75	50	100	0	a2112	a21 8
50	100	75	100	0	a2112	* 38
75	100	75	75	1	a2112	a2116
75	75	50	75	0	a3112	a3111
50	75	50	100	0	a3112	a31 8
50	100	75	100	0	a3112	* 39
75	100	75	75	1	a3112	a3116
75	75	50	75	0	a4112	a4111
50	75	50	100	0	a4112	a41 8
50	100	75	100	0	a4112	* 40
75	100	75	75	1	a4112	a4116
100	0	75	0	0	a1113	* 41
75	0	75	25	0	a1113	a11 9
75	25	100	25	1	a1113	a1114
100	25	100	0	0	a1113	* 42
100	0	75	0	0	a2113	* 43
75	0	75	25	0	a2113	a21 9
75	25	100	25	1	a2113	a2114
100	25	100	0	0	a2113	* 44
100	0	75	0	0	a3113	* 45
75	0	75	25	0	a3113	a31 9
75	25	100	25	1	a3113	a3114
100	25	100	0	0	a3113	* 46
100	0	75	0	0	a4113	* 47
75	0	75	25	0	a4113	a41 9
75	25	100	25	1	a4113	a4114
100	25	100	0	0	a4113	* 48
75	25	75	50	0	a1114	a1110
75	50	100	50	1	a1114	a1115
100	50	100	25	0	a1114	* 49
100	25	75	25	0	a1114	a1113
75	25	75	50	0	a2114	a2110
75	50	100	50	1	a2114	a2115
100	50	100	25	0	a2114	* 50
100	25	75	25	0	a2114	a2113
75	25	75	50	0	a3114	a3110
75	50	100	50	1	a3114	a3115
100	50	100	25	0	a3114	* 51
100	25	75	25	0	a3114	a3113
75	25	75	50	0	a4114	a4110

75	50	100	50	1	a4114	a4115
100	50	100	25	0	a4114	* 52
100	25	75	25	0	a4114	a4113
100	50	75	50	0	a1115	a1114
75	50	75	75	0	a1115	a1111
75	75	100	75	1	a1115	a1116
100	75	100	50	0	a1115	* 53
100	50	75	50	0	a2115	a2114
75	50	75	75	0	a2115	a2111
75	75	100	75	1	a2115	a2116
100	75	100	50	0	a2115	* 54
100	50	75	50	0	a3115	a3114
75	50	75	75	0	a3115	a3111
75	75	100	75	1	a3115	a3116
100	75	100	50	0	a3115	* 55
100	50	75	50	0	a4115	a4114
75	50	75	75	0	a4115	a4111
75	75	100	75	1	a4115	a4116
100	75	100	50	0	a4115	* 56
100	100	100	75	0	a1116	* 57
100	75	75	75	0	a1116	a1115
75	75	75	100	0	a1116	a1112
75	100	100	100	0	a1116	* 58
100	100	100	75	0	a2116	* 59
100	75	75	75	0	a2116	a2115
75	75	75	100	0	a2116	a2112
75	100	100	100	0	a2116	* 60
100	100	100	75	0	a3116	* 61
100	75	75	75	0	a3116	a3115
75	75	75	100	0	a3116	a3112
75	100	100	100	0	a3116	* 62
100	100	100	75	0	a4116	* 63
100	75	75	75	0	a4116	a4115
75	75	75	100	0	a4116	a4112
75	100	100	100	0	a4116	* 64

Example 3.3.4 Uniform 3D grid spacing in a rectangular domain, layers slope 10° in x-direction
Test Case and Expected Output as Provided in the AMESH User's Manual

The author of the AMESH User's Manual erred in the example input file for this test case. That the domain is to be rectangular is made clear in the example's title, as well as in the x- and y-coordinates provided in the LOCAT block below. However, the BOUND block, which defines the aerial boundaries of the mesh, only provides three pairs of x-y coordinates, forming a right-triangular system half the size of the intended rectangular domain. As stated in the User's Manual, page 13, the xy coordinates provided below in LOCAT that are outside this triangular BOUND are ignored, and the expected output in ELEME, CONNE, and SEGMT are not obtained. In order to obtain the anticipated output, a fourth xy pair (100,0) must be included in the BOUND block.

filename: IN

```
locat
a11 1 101     12.5000000000  12.5000000000  50.00000       10.0000
a21 1 102     12.5000000000  12.5000000000  40.00000       10.0000
a31 1 103     12.5000000000  12.5000000000  30.00000       10.0000
a41 1 104     12.5000000000  12.5000000000  20.00000       10.0000
a11 2 101     12.5000000000  37.5000000000  50.00000       10.0000
a21 2 102     12.5000000000  37.5000000000  40.00000       10.0000
a31 2 103     12.5000000000  37.5000000000  30.00000       10.0000
a41 2 104     12.5000000000  37.5000000000  20.00000       10.0000
a11 3 101     12.5000000000  62.5000000000  50.00000       10.0000
a21 3 102     12.5000000000  62.5000000000  40.00000       10.0000
a31 3 103     12.5000000000  62.5000000000  30.00000       10.0000
a41 3 104     12.5000000000  62.5000000000  20.00000       10.0000
a11 4 101     12.5000000000  87.5000000000  50.00000       10.0000
a21 4 102     12.5000000000  87.5000000000  40.00000       10.0000
a31 4 103     12.5000000000  87.5000000000  30.00000       10.0000
a41 4 104     12.5000000000  87.5000000000  20.00000       10.0000
a11 5 101     37.5000000000  12.5000000000  45.59183       10.0000
a21 5 102     37.5000000000  12.5000000000  35.59183       10.0000
a31 5 103     37.5000000000  12.5000000000  25.59183       10.0000
a41 5 104     37.5000000000  12.5000000000  15.59183       10.0000
a11 6 101     37.5000000000  37.5000000000  45.59183       10.0000
a21 6 102     37.5000000000  37.5000000000  35.59183       10.0000
a31 6 103     37.5000000000  37.5000000000  25.59183       10.0000
a41 6 104     37.5000000000  37.5000000000  15.59183       10.0000
a11 7 101     37.5000000000  62.5000000000  45.59183       10.0000
a21 7 102     37.5000000000  62.5000000000  35.59183       10.0000
a31 7 103     37.5000000000  62.5000000000  25.59183       10.0000
a41 7 104     37.5000000000  62.5000000000  15.59183       10.0000
a11 8 101     37.5000000000  87.5000000000  45.59183       10.0000
a21 8 102     37.5000000000  87.5000000000  35.59183       10.0000
a31 8 103     37.5000000000  87.5000000000  25.59183       10.0000
a41 8 104     37.5000000000  87.5000000000  15.59183       10.0000
a11 9 101     62.5000000000  12.5000000000  41.18365       10.0000
a21 9 102     62.5000000000  12.5000000000  31.18365       10.0000
a31 9 103     62.5000000000  12.5000000000  21.18365       10.0000
a41 9 104     62.5000000000  12.5000000000  11.18365       10.0000
a1110 101     62.5000000000  37.5000000000  41.18365       10.0000
a2110 102     62.5000000000  37.5000000000  31.18365       10.0000
a3110 103     62.5000000000  37.5000000000  21.18365       10.0000
a4110 104     62.5000000000  37.5000000000  11.18365       10.0000
a1111 101     62.5000000000  62.5000000000  41.18365       10.0000
a2111 102     62.5000000000  62.5000000000  31.18365       10.0000
a3111 103     62.5000000000  62.5000000000  21.18365       10.0000
a4111 104     62.5000000000  62.5000000000  11.18365       10.0000
a1112 101     62.5000000000  87.5000000000  41.18365       10.0000
a2112 102     62.5000000000  87.5000000000  31.18365       10.0000
a3112 103     62.5000000000  87.5000000000  21.18365       10.0000
a4112 104     62.5000000000  87.5000000000  11.18365       10.0000
a1113 101     87.5000000000  12.5000000000  36.77548       10.0000
a2113 102     87.5000000000  12.5000000000  26.77548       10.0000
a3113 103     87.5000000000  12.5000000000  16.77548       10.0000
a4113 104     87.5000000000  12.5000000000  6.77548        10.0000
a1114 101     87.5000000000  37.5000000000  36.77548       10.0000
```

```
a2114  102     87.5000000000  37.5000000000  26.77548       10.0000
a3114  103     87.5000000000  37.5000000000  16.77548       10.0000
a4114  104     87.5000000000  37.5000000000  6.77548        10.0000
a1115  101     87.5000000000  62.5000000000  36.77548       10.0000
a2115  102     87.5000000000  62.5000000000  26.77548       10.0000
a3115  103     87.5000000000  62.5000000000  16.77548       10.0000
a4115  104     87.5000000000  62.5000000000  6.77548        10.0000
a1116  101     87.5000000000  87.5000000000  36.77548       10.0000
a2116  102     87.5000000000  87.5000000000  26.77548       10.0000
a3116  103     87.5000000000  87.5000000000  16.77548       10.0000
a4116  104     87.5000000000  87.5000000000  6.77548        10.0000

bound
0.0    0.0      !This boundary array is an error by the author of the User's Manual. For a rectangular domain, as
0.0    100.0    !specified by the title of the example, four (4) pairs of boundary coordinates must be defined,
100.0  100.0    !not three (3) as is the implication here. The fourth entry should be (100.0, 0.0)

toler
0.5
```

filename: ELEME

```
eleme
a11 1  rock1   6.250e+03      12.500  12.500  50.0000
a21 1  rock1   6.250e+03      12.500  12.500  40.0000
a31 1  rock1   6.250e+03      12.500  12.500  30.0000
a41 1  rock1   6.250e+03      12.500  12.500  20.0000
a11 2  rock1   6.250e+03      12.500  37.500  50.0000
a21 2  rock1   6.250e+03      12.500  37.500  40.0000
a31 2  rock1   6.250e+03      12.500  37.500  30.0000
a41 2  rock1   6.250e+03      12.500  37.500  20.0000
a11 3  rock1   6.250e+03      12.500  62.500  50.0000
a21 3  rock1   6.250e+03      12.500  62.500  40.0000
a31 3  rock1   6.250e+03      12.500  62.500  30.0000
a41 3  rock1   6.250e+03      12.500  62.500  20.0000
a11 4  rock1   6.250e+03      12.500  87.500  50.0000
a21 4  rock1   6.250e+03      12.500  87.500  40.0000
a31 4  rock1   6.250e+03      12.500  87.500  30.0000
a41 4  rock1   6.250e+03      12.500  87.500  20.0000
a11 5  rock1   6.250e+03      37.500  12.500  45.5918
a21 5  rock1   6.250e+03      37.500  12.500  35.5918
a31 5  rock1   6.250e+03      37.500  12.500  25.5918
a41 5  rock1   6.250e+03      37.500  12.500  15.5918
a11 6  rock1   6.250e+03      37.500  37.500  45.5918
a21 6  rock1   6.250e+03      37.500  37.500  35.5918
a31 6  rock1   6.250e+03      37.500  37.500  25.5918
a41 6  rock1   6.250e+03      37.500  37.500  15.5918
....
a1114  rock1   6.250e+03      87.500  37.500  36.7755
a2114  rock1   6.250e+03      87.500  37.500  26.7755
a3114  rock1   6.250e+03      87.500  37.500  16.7755
a4114  rock1   6.250e+03      87.500  37.500  6.7755
a1115  rock1   6.250e+03      87.500  62.500  36.7755
a2115  rock1   6.250e+03      87.500  62.500  26.7755
a3115  rock1   6.250e+03      87.500  62.500  16.7755
a4115  rock1   6.250e+03      87.500  62.500  6.7755
a1116  rock1   6.250e+03      87.500  87.500  36.7755
a2116  rock1   6.250e+03      87.500  87.500  26.7755
a3116  rock1   6.250e+03      87.500  87.500  16.7755
a4116  rock1   6.250e+03      87.500  87.500  6.7755
```

filename: CONNE

```
conne
a11 1  a11 2  1      1.250e+01      1.250e+01      2.500e+02      0.0
a11 1  a11 5  1      1.250e+01      1.250e+01      2.500e+02      -1.736e-01
a21 1  a21 2  1      1.250e+01      1.250e+01      2.500e+02      0.0
a21 1  a21 5  1      1.250e+01      1.250e+01      2.500e+02      -1.736e-01
a21 1  a11 1  3      5.000e+00      5.000e+00      6.250e+02      1.0
a31 1  a31 2  1      1.250e+01      1.250e+01      2.500e+02      0.0
a31 1  a31 5  1      1.250e+01      1.250e+01      2.500e+02      -1.736e-01
```

```
a31 1 a21 1   3       5.000e+00       5.000e+00       6.250e+02       1.0
a41 1 a41 2   1       1.250e+01       1.250e+01       2.500e+02       0.0
a41 1 a41 5   1       1.250e+01       1.250e+01       2.500e+02       -1.736e-01
a41 1 a31 1   3       5.000e+00       5.000e+00       6.250e+02       1.0
a11 2 a11 3   1       1.250e+01       1.250e+01       2.500e+02       0.0
a11 2 a11 6   1       1.250e+01       1.250e+01       2.500e+02       -1.736e-01
a21 2 a21 3   1       1.250e+01       1.250e+01       2.500e+02       0.0
a21 2 a21 6   1       1.250e+01       1.250e+01       2.500e+02       -1.736e-01
a21 2 a11 2   3       5.000e+00       5.000e+00       6.250e+02       1.0
a31 2 a31 3   1       1.250e+01       1.250e+01       2.500e+02       0.0
a31 2 a31 6   1       1.250e+01       1.250e+01       2.500e+02       -1.736e-01
a31 2 a21 2   3       5.000e+00       5.000e+00       6.250e+02       1.0
a41 2 a41 3   1       1.250e+01       1.250e+01       2.500e+02       0.0
a41 2 a41 6   1       1.250e+01       1.250e+01       2.500e+02       -1.736e-01
a41 2 a31 2   3       5.000e+00       5.000e+00       6.250e+02       1.0
a11 3 a11 4   1       1.250e+01       1.250e+01       2.500e+02       0.0
a11 3 a11 7   1       1.250e+01       1.250e+01       2.500e+02       -1.736e-01
a21 3 a21 4   1       1.250e+01       1.250e+01       2.500e+02       0.0
....
a3114 a2114   3       5.000e+00       5.000e+00       6.250e+02       1.0
a4114 a4115   1       1.250e+01       1.250e+01       2.500e+02       0.0
a4114 a3114   3       5.000e+00       5.000e+00       6.250e+02       1.0
a1115 a1116   1       1.250e+01       1.250e+01       2.500e+02       0.0
a2115 a2116   1       1.250e+01       1.250e+01       2.500e+02       0.0
a2115 a1115   3       5.000e+00       5.000e+00       6.250e+02       1.0
a3115 a3116   1       1.250e+01       1.250e+01       2.500e+02       0.0
a3115 a2115   3       5.000e+00       5.000e+00       6.250e+02       1.0
a4115 a4116   1       1.250e+01       1.250e+01       2.500e+02       0.0
a4115 a3115   3       5.000e+00       5.000e+00       6.250e+02       1.0
a2116 a1116   3       5.000e+00       5.000e+00       6.250e+02       1.0
a3116 a2116   3       5.000e+00       5.000e+00       6.250e+02       1.0
a4116 a3116   3       5.000e+00       5.000e+00       6.250e+02       1.0
```

filename: SEGMT

```
0       0       0       25      0       a11 1   *   1
0       25      25      25      1       a11 1   a11 2
25      25      25      0       1       a11 1   a11 5
25      0       0       0       0       a11 1   *   2
0       0       0       25      0       a21 1   *   3
0       25      25      25      1       a21 1   a21 2
25      25      25      0       1       a21 1   a21 5
25      0       0       0       0       a21 1   *   4
0       0       0       25      0       a31 1   *   5
0       25      25      25      1       a31 1   a31 2
25      25      25      0       1       a31 1   a31 5
25      0       0       0       0       a31 1   *   6
0       0       0       25      0       a41 1   *   7
0       25      25      25      1       a41 1   a41 2
25      25      25      0       1       a41 1   a41 5
25      0       0       0       0       a41 1   *   8
0       25      0       50      0       a11 2   *   9
0       50      25      50      1       a11 2   a11 3
25      50      25      25      1       a11 2   a11 6
....
100     50      75      50      0       a4115   a4114
75      50      75      75      0       a4115   a4111
75      75      100     75      1       a4115   a4116
100     75      100     50      0       a4115   *  56
100     100     100     75      0       a1116   *  57
100     75      75      75      0       a1116   a1115
75      75      75      100     0       a1116   a1112
75      100     100     100     0       a1116   *  58
100     100     100     75      0       a2116   *  59
100     75      75      75      0       a2116   a2115
75      75      75      100     0       a2116   a2112
75      100     100     100     0       a2116   *  60
100     100     100     75      0       a3116   *  61
100     75      75      75      0       a3116   a3115
75      75      75      100     0       a3116   a3112
75      100     100     100     0       a3116   *  62
100     100     100     75      0       a4116   *  63
```

```
100     75      75      75      0       a4116   a4115
75      75      75      100     0       a4116   a4112
75      100     100     100     0       a4116   *  64
```

Example 3.3.4 Uniform 3D grid spacing in a rectangular domain, layers slope 10° in x-direction
Acceptance Test: Results Generated by AMESH

filename: IN

```
locat
a11 1 101     12.5000000000  12.5000000000  50.00000       10.0000
a21 1 102     12.5000000000  12.5000000000  40.00000       10.0000
a31 1 103     12.5000000000  12.5000000000  30.00000       10.0000
a41 1 104     12.5000000000  12.5000000000  20.00000       10.0000
a11 2 101     12.5000000000  37.5000000000  50.00000       10.0000
a21 2 102     12.5000000000  37.5000000000  40.00000       10.0000
a31 2 103     12.5000000000  37.5000000000  30.00000       10.0000
a41 2 104     12.5000000000  37.5000000000  20.00000       10.0000
a11 3 101     12.5000000000  62.5000000000  50.00000       10.0000
a21 3 102     12.5000000000  62.5000000000  40.00000       10.0000
a31 3 103     12.5000000000  62.5000000000  30.00000       10.0000
a41 3 104     12.5000000000  62.5000000000  20.00000       10.0000
a11 4 101     12.5000000000  87.5000000000  50.00000       10.0000
a21 4 102     12.5000000000  87.5000000000  40.00000       10.0000
a31 4 103     12.5000000000  87.5000000000  30.00000       10.0000
a41 4 104     12.5000000000  87.5000000000  20.00000       10.0000
a11 5 101     37.5000000000  12.5000000000  45.59183       10.0000
a21 5 102     37.5000000000  12.5000000000  35.59183       10.0000
a31 5 103     37.5000000000  12.5000000000  25.59183       10.0000
a41 5 104     37.5000000000  12.5000000000  15.59183       10.0000
a11 6 101     37.5000000000  37.5000000000  45.59183       10.0000
a21 6 102     37.5000000000  37.5000000000  35.59183       10.0000
a31 6 103     37.5000000000  37.5000000000  25.59183       10.0000
a41 6 104     37.5000000000  37.5000000000  15.59183       10.0000
a11 7 101     37.5000000000  62.5000000000  45.59183       10.0000
a21 7 102     37.5000000000  62.5000000000  35.59183       10.0000
a31 7 103     37.5000000000  62.5000000000  25.59183       10.0000
a41 7 104     37.5000000000  62.5000000000  15.59183       10.0000
a11 8 101     37.5000000000  87.5000000000  45.59183       10.0000
a21 8 102     37.5000000000  87.5000000000  35.59183       10.0000
a31 8 103     37.5000000000  87.5000000000  25.59183       10.0000
a41 8 104     37.5000000000  87.5000000000  15.59183       10.0000
a11 9 101     62.5000000000  12.5000000000  41.18365       10.0000
a21 9 102     62.5000000000  12.5000000000  31.18365       10.0000
a31 9 103     62.5000000000  12.5000000000  21.18365       10.0000
a41 9 104     62.5000000000  12.5000000000  11.18365       10.0000
a1110 101     62.5000000000  37.5000000000  41.18365       10.0000
a2110 102     62.5000000000  37.5000000000  31.18365       10.0000
a3110 103     62.5000000000  37.5000000000  21.18365       10.0000
a4110 104     62.5000000000  37.5000000000  11.18365       10.0000
a1111 101     62.5000000000  62.5000000000  41.18365       10.0000
a2111 102     62.5000000000  62.5000000000  31.18365       10.0000
a3111 103     62.5000000000  62.5000000000  21.18365       10.0000
a4111 104     62.5000000000  62.5000000000  11.18365       10.0000
a1112 101     62.5000000000  87.5000000000  41.18365       10.0000
a2112 102     62.5000000000  87.5000000000  31.18365       10.0000
a3112 103     62.5000000000  87.5000000000  21.18365       10.0000
a4112 104     62.5000000000  87.5000000000  11.18365       10.0000
a1113 101     87.5000000000  12.5000000000  36.77548       10.0000
a2113 102     87.5000000000  12.5000000000  26.77548       10.0000
a3113 103     87.5000000000  12.5000000000  16.77548       10.0000
a4113 104     87.5000000000  12.5000000000   6.77548       10.0000
a1114 101     87.5000000000  37.5000000000  36.77548       10.0000
a2114 102     87.5000000000  37.5000000000  26.77548       10.0000
a3114 103     87.5000000000  37.5000000000  16.77548       10.0000
a4114 104     87.5000000000  37.5000000000   6.77548       10.0000
a1115 101     87.5000000000  62.5000000000  36.77548       10.0000
a2115 102     87.5000000000  62.5000000000  26.77548       10.0000
a3115 103     87.5000000000  62.5000000000  16.77548       10.0000
a4115 104     87.5000000000  62.5000000000   6.77548       10.0000
a1116 101     87.5000000000  87.5000000000  36.77548       10.0000
a2116 102     87.5000000000  87.5000000000  26.77548       10.0000
```

a3116	103	87.5000000000	87.5000000000	16.77548	10.0000
a4116	104	87.5000000000	87.5000000000	6.77548	10.0000

```
bound
0.0    0.0
0.0    100.0
100.0  100.0
100.0  0.0      ! Note that the fourth pair of xy coordinates for the desired model grid has been correctly included.

toler
0.5
```

filename: ELEME

```
eleme
a11 1          rock1 6.250e+03          12.500      12.500      50.0000
a21 1          rock1 6.250e+03          12.500      12.500      40.0000
a31 1          rock1 6.250e+03          12.500      12.500      30.0000
a41 1          rock1 6.250e+03          12.500      12.500      20.0000
a11 2          rock1 6.250e+03          12.500      37.500      50.0000
a21 2          rock1 6.250e+03          12.500      37.500      40.0000
a31 2          rock1 6.250e+03          12.500      37.500      30.0000
a41 2          rock1 6.250e+03          12.500      37.500      20.0000
a11 3          rock1 6.250e+03          12.500      62.500      50.0000
a21 3          rock1 6.250e+03          12.500      62.500      40.0000
a31 3          rock1 6.250e+03          12.500      62.500      30.0000
a41 3          rock1 6.250e+03          12.500      62.500      20.0000
a11 4          rock1 6.250e+03          12.500      87.500      50.0000
a21 4          rock1 6.250e+03          12.500      87.500      40.0000
a31 4          rock1 6.250e+03          12.500      87.500      30.0000
a41 4          rock1 6.250e+03          12.500      87.500      20.0000
a11 5          rock1 6.250e+03          37.500      12.500      45.5918
a21 5          rock1 6.250e+03          37.500      12.500      35.5918
a31 5          rock1 6.250e+03          37.500      12.500      25.5918
a41 5          rock1 6.250e+03          37.500      12.500      15.5918
a11 6          rock1 6.250e+03          37.500      37.500      45.5918
a21 6          rock1 6.250e+03          37.500      37.500      35.5918
a31 6          rock1 6.250e+03          37.500      37.500      25.5918
a41 6          rock1 6.250e+03          37.500      37.500      15.5918
a11 7          rock1 6.250e+03          37.500      62.500      45.5918
a21 7          rock1 6.250e+03          37.500      62.500      35.5918
a31 7          rock1 6.250e+03          37.500      62.500      25.5918
a41 7          rock1 6.250e+03          37.500      62.500      15.5918
a11 8          rock1 6.250e+03          37.500      87.500      45.5918
a21 8          rock1 6.250e+03          37.500      87.500      35.5918
a31 8          rock1 6.250e+03          37.500      87.500      25.5918
a41 8          rock1 6.250e+03          37.500      87.500      15.5918
a11 9          rock1 6.250e+03          62.500      12.500      41.1837
a21 9          rock1 6.250e+03          62.500      12.500      31.1837
a31 9          rock1 6.250e+03          62.500      12.500      21.1837
a41 9          rock1 6.250e+03          62.500      12.500      11.1837
a1110          rock1 6.250e+03          62.500      37.500      41.1837
a2110          rock1 6.250e+03          62.500      37.500      31.1837
a3110          rock1 6.250e+03          62.500      37.500      21.1837
a4110          rock1 6.250e+03          62.500      37.500      11.1837
a1111          rock1 6.250e+03          62.500      62.500      41.1837
a2111          rock1 6.250e+03          62.500      62.500      31.1837
a3111          rock1 6.250e+03          62.500      62.500      21.1837
a4111          rock1 6.250e+03          62.500      62.500      11.1837
a1112          rock1 6.250e+03          62.500      87.500      41.1837
a2112          rock1 6.250e+03          62.500      87.500      31.1837
a3112          rock1 6.250e+03          62.500      87.500      21.1837
a4112          rock1 6.250e+03          62.500      87.500      11.1837
a1113          rock1 6.250e+03          87.500      12.500      36.7755
a2113          rock1 6.250e+03          87.500      12.500      26.7755
a3113          rock1 6.250e+03          87.500      12.500      16.7755
a4113          rock1 6.250e+03          87.500      12.500       6.7755
a1114          rock1 6.250e+03          87.500      37.500      36.7755
a2114          rock1 6.250e+03          87.500      37.500      26.7755
a3114          rock1 6.250e+03          87.500      37.500      16.7755
a4114          rock1 6.250e+03          87.500      37.500       6.7755
a1115          rock1 6.250e+03          87.500      62.500      36.7755
a2115          rock1 6.250e+03          87.500      62.500      26.7755
a3115          rock1 6.250e+03          87.500      62.500      16.7755
a4115          rock1 6.250e+03          87.500      62.500       6.7755
a1116          rock1 6.250e+03          87.500      87.500      36.7755
a2116          rock1 6.250e+03          87.500      87.500      26.7755
a3116          rock1 6.250e+03          87.500      87.500      16.7755
a4116          rock1 6.250e+03          87.500      87.500       6.7755
```

filename: CONNE

```
conne
a11 1 *   1                1 1.250e+01 0.000e+00 2.500e+02
a11 1 a11 2                1 1.250e+01 1.250e+01 2.500e+02
a11 1 a11 5                1 1.250e+01 1.250e+01 2.500e+02       -1.736e-01
a11 1 *   2                1 1.250e+01 0.000e+00 2.500e+02
a21 1 *   3                1 1.250e+01 0.000e+00 2.500e+02
a21 1 a21 2                1 1.250e+01 1.250e+01 2.500e+02
a21 1 a21 5                1 1.250e+01 1.250e+01 2.500e+02       -1.736e-01
a21 1 *   4                1 1.250e+01 0.000e+00 2.500e+02
a21 1 a11 1                1 5.000e+00 5.000e+00 6.250e+02        1.
a31 1 *   5                1 1.250e+01 0.000e+00 2.500e+02
a31 1 a31 2                1 1.250e+01 1.250e+01 2.500e+02
a31 1 a31 5                1 1.250e+01 1.250e+01 2.500e+02       -1.736e-01
a31 1 *   6                1 1.250e+01 0.000e+00 2.500e+02
a31 1 a21 1                1 5.000e+00 5.000e+00 6.250e+02        1.
a41 1 *   7                1 1.250e+01 0.000e+00 2.500e+02
a41 1 a41 2                1 1.250e+01 1.250e+01 2.500e+02
a41 1 a41 5                1 1.250e+01 1.250e+01 2.500e+02       -1.736e-01
a41 1 *   8                1 1.250e+01 0.000e+00 2.500e+02
a41 1 a31 1                1 5.000e+00 5.000e+00 6.250e+02        1.
a11 2 *   9                1 1.250e+01 0.000e+00 2.500e+02
a11 2 a11 3                1 1.250e+01 1.250e+01 2.500e+02
a11 2 a11 6                1 1.250e+01 1.250e+01 2.500e+02       -1.736e-01
a21 2 *  10                1 1.250e+01 0.000e+00 2.500e+02
a21 2 a21 3                1 1.250e+01 1.250e+01 2.500e+02
a21 2 a21 6                1 1.250e+01 1.250e+01 2.500e+02       -1.736e-01
a21 2 a11 2                1 5.000e+00 5.000e+00 6.250e+02        1.
a31 2 *  11                1 1.250e+01 0.000e+00 2.500e+02
a31 2 a31 3                1 1.250e+01 1.250e+01 2.500e+02
a31 2 a31 6                1 1.250e+01 1.250e+01 2.500e+02       -1.736e-01
a31 2 a21 2                1 5.000e+00 5.000e+00 6.250e+02        1.
a41 2 *  12                1 1.250e+01 0.000e+00 2.500e+02
a41 2 a41 3                1 1.250e+01 1.250e+01 2.500e+02
a41 2 a41 6                1 1.250e+01 1.250e+01 2.500e+02       -1.736e-01
a41 2 a31 2                1 5.000e+00 5.000e+00 6.250e+02        1.
a11 3 *  13                1 1.250e+01 0.000e+00 2.500e+02
a11 3 a11 4                1 1.250e+01 1.250e+01 2.500e+02
a11 3 a11 7                1 1.250e+01 1.250e+01 2.500e+02       -1.736e-01
a21 3 *  14                1 1.250e+01 0.000e+00 2.500e+02
a21 3 a21 4                1 1.250e+01 1.250e+01 2.500e+02
a21 3 a21 7                1 1.250e+01 1.250e+01 2.500e+02       -1.736e-01
a21 3 a11 3                1 5.000e+00 5.000e+00 6.250e+02        1.
a31 3 *  15                1 1.250e+01 0.000e+00 2.500e+02
a31 3 a31 4                1 1.250e+01 1.250e+01 2.500e+02
a31 3 a31 7                1 1.250e+01 1.250e+01 2.500e+02       -1.736e-01
a31 3 a21 3                1 5.000e+00 5.000e+00 6.250e+02        1.
a41 3 *  16                1 1.250e+01 0.000e+00 2.500e+02
a41 3 a41 4                1 1.250e+01 1.250e+01 2.500e+02
a41 3 a41 7                1 1.250e+01 1.250e+01 2.500e+02       -1.736e-01
a41 3 a31 3                1 5.000e+00 5.000e+00 6.250e+02        1.
a11 4 *  17                1 1.250e+01 0.000e+00 2.500e+02
a11 4 a11 8                1 1.250e+01 1.250e+01 2.500e+02       -1.736e-01
a11 4 *  18                1 1.250e+01 0.000e+00 2.500e+02
a21 4 *  19                1 1.250e+01 0.000e+00 2.500e+02
a21 4 a21 8                1 1.250e+01 1.250e+01 2.500e+02       -1.736e-01
a21 4 *  20                1 1.250e+01 0.000e+00 2.500e+02
a21 4 a11 4                1 5.000e+00 5.000e+00 6.250e+02        1.
a31 4 *  21                1 1.250e+01 0.000e+00 2.500e+02
a31 4 a31 8                1 1.250e+01 1.250e+01 2.500e+02       -1.736e-01
a31 4 *  22                1 1.250e+01 0.000e+00 2.500e+02
a31 4 a21 4                1 5.000e+00 5.000e+00 6.250e+02        1.
a41 4 *  23                1 1.250e+01 0.000e+00 2.500e+02
a41 4 a41 8                1 1.250e+01 1.250e+01 2.500e+02       -1.736e-01
a41 4 *  24                1 1.250e+01 0.000e+00 2.500e+02
a41 4 a31 4                1 5.000e+00 5.000e+00 6.250e+02        1.
a11 5 a11 6                1 1.250e+01 1.250e+01 2.500e+02
a11 5 a11 9                1 1.250e+01 1.250e+01 2.500e+02       -1.736e-01
a11 5 *  25                1 1.250e+01 0.000e+00 2.500e+02
a21 5 a21 6                1 1.250e+01 1.250e+01 2.500e+02
a21 5 a21 9                1 1.250e+01 1.250e+01 2.500e+02       -1.736e-01
a21 5 *  26                1 1.250e+01 0.000e+00 2.500e+02
a21 5 a11 5                1 5.000e+00 5.000e+00 6.250e+02        1.
```

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a31 5 a31 6          1 1.250e+01 1.250e+01 2.500e+02
a31 5 a31 9          1 1.250e+01 1.250e+01 2.500e+02       -1.736e-01
a31 5 *  27         1 1.250e+01 0.000e+00 2.500e+02
a31 5 a21 5          1 5.000e+00 5.000e+00 6.250e+02        1.
a41 5 a41 6          1 1.250e+01 1.250e+01 2.500e+02
a41 5 a41 9          1 1.250e+01 1.250e+01 2.500e+02       -1.736e-01
a41 5 *  28         1 1.250e+01 0.000e+00 2.500e+02
a41 5 a31 5          1 5.000e+00 5.000e+00 6.250e+02        1.
a11 6 a11 7          1 1.250e+01 1.250e+01 2.500e+02
a11 6 a1110          1 1.250e+01 1.250e+01 2.500e+02       -1.736e-01
a21 6 a21 7          1 1.250e+01 1.250e+01 2.500e+02
a21 6 a2110          1 1.250e+01 1.250e+01 2.500e+02       -1.736e-01
a21 6 a11 6          1 5.000e+00 5.000e+00 6.250e+02        1.
a31 6 a31 7          1 1.250e+01 1.250e+01 2.500e+02
a31 6 a3110          1 1.250e+01 1.250e+01 2.500e+02       -1.736e-01
a31 6 a21 6          1 5.000e+00 5.000e+00 6.250e+02        1.
a41 6 a41 7          1 1.250e+01 1.250e+01 2.500e+02
a41 6 a4110          1 1.250e+01 1.250e+01 2.500e+02       -1.736e-01
a41 6 a31 6          1 5.000e+00 5.000e+00 6.250e+02        1.
a11 7 a11 8          1 1.250e+01 1.250e+01 2.500e+02
a11 7 a1111          1 1.250e+01 1.250e+01 2.500e+02       -1.736e-01
a21 7 a21 8          1 1.250e+01 1.250e+01 2.500e+02
a21 7 a2111          1 1.250e+01 1.250e+01 2.500e+02       -1.736e-01
a21 7 a11 7          1 5.000e+00 5.000e+00 6.250e+02        1.
a31 7 a31 8          1 1.250e+01 1.250e+01 2.500e+02
a31 7 a3111          1 1.250e+01 1.250e+01 2.500e+02       -1.736e-01
a31 7 a21 7          1 5.000e+00 5.000e+00 6.250e+02        1.
a41 7 a41 8          1 1.250e+01 1.250e+01 2.500e+02
a41 7 a4111          1 1.250e+01 1.250e+01 2.500e+02       -1.736e-01
a41 7 a31 7          1 5.000e+00 5.000e+00 6.250e+02        1.
a11 8 *  29         1 1.250e+01 0.000e+00 2.500e+02
a11 8 a1112          1 1.250e+01 1.250e+01 2.500e+02       -1.736e-01
a21 8 *  30         1 1.250e+01 0.000e+00 2.500e+02
a21 8 a2112          1 1.250e+01 1.250e+01 2.500e+02       -1.736e-01
a21 8 a11 8          1 5.000e+00 5.000e+00 6.250e+02        1.
a31 8 *  31         1 1.250e+01 0.000e+00 2.500e+02
a31 8 a3112          1 1.250e+01 1.250e+01 2.500e+02       -1.736e-01
a31 8 a21 8          1 5.000e+00 5.000e+00 6.250e+02        1.
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a41 8 a31 8          1 5.000e+00 5.000e+00 6.250e+02        1.
a11 9 a1110          1 1.250e+01 1.250e+01 2.500e+02
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a11 9 *  33         1 1.250e+01 0.000e+00 2.500e+02
a21 9 a2110          1 1.250e+01 1.250e+01 2.500e+02
a21 9 a2113          1 1.250e+01 1.250e+01 2.500e+02       -1.736e-01
a21 9 *  34         1 1.250e+01 0.000e+00 2.500e+02
a21 9 a11 9          1 5.000e+00 5.000e+00 6.250e+02        1.
a31 9 a3110          1 1.250e+01 1.250e+01 2.500e+02
a31 9 a3113          1 1.250e+01 1.250e+01 2.500e+02       -1.736e-01
a31 9 *  35         1 1.250e+01 0.000e+00 2.500e+02
a31 9 a21 9          1 5.000e+00 5.000e+00 6.250e+02        1.
a41 9 a4110          1 1.250e+01 1.250e+01 2.500e+02
a41 9 a4113          1 1.250e+01 1.250e+01 2.500e+02       -1.736e-01
a41 9 *  36         1 1.250e+01 0.000e+00 2.500e+02
a41 9 a31 9          1 5.000e+00 5.000e+00 6.250e+02        1.
a1110 a1111          1 1.250e+01 1.250e+01 2.500e+02
a1110 a1114          1 1.250e+01 1.250e+01 2.500e+02       -1.736e-01
a2110 a2111          1 1.250e+01 1.250e+01 2.500e+02
a2110 a2114          1 1.250e+01 1.250e+01 2.500e+02       -1.736e-01
a2110 a1110          1 5.000e+00 5.000e+00 6.250e+02        1.
a3110 a3111          1 1.250e+01 1.250e+01 2.500e+02
a3110 a3114          1 1.250e+01 1.250e+01 2.500e+02       -1.736e-01
a3110 a2110          1 5.000e+00 5.000e+00 6.250e+02        1.
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a1111 a1112          1 1.250e+01 1.250e+01 2.500e+02
a1111 a1115          1 1.250e+01 1.250e+01 2.500e+02       -1.736e-01
a2111 a2112          1 1.250e+01 1.250e+01 2.500e+02
a2111 a2115          1 1.250e+01 1.250e+01 2.500e+02       -1.736e-01
a2111 a1111          1 5.000e+00 5.000e+00 6.250e+02        1.
a3111 a3112          1 1.250e+01 1.250e+01 2.500e+02
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a4111 a3111              1 5.000e+00 5.000e+00 6.250e+02        1.
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a3112 *  39              1 1.250e+01 0.000e+00 2.500e+02
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a1113 *  42              1 1.250e+01 0.000e+00 2.500e+02
a2113 *  43              1 1.250e+01 0.000e+00 2.500e+02
a2113 a2114              1 1.250e+01 1.250e+01 2.500e+02
a2113 *  44              1 1.250e+01 0.000e+00 2.500e+02
a2113 a1113              1 5.000e+00 5.000e+00 6.250e+02        1.
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a3113 *  46              1 1.250e+01 0.000e+00 2.500e+02
a3113 a2113              1 5.000e+00 5.000e+00 6.250e+02        1.
a4113 *  47              1 1.250e+01 0.000e+00 2.500e+02
a4113 a4114              1 1.250e+01 1.250e+01 2.500e+02
a4113 *  48              1 1.250e+01 0.000e+00 2.500e+02
a4113 a3113              1 5.000e+00 5.000e+00 6.250e+02        1.
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a1114 *  49              1 1.250e+01 0.000e+00 2.500e+02
a2114 a2115              1 1.250e+01 1.250e+01 2.500e+02
a2114 *  50              1 1.250e+01 0.000e+00 2.500e+02
a2114 a1114              1 5.000e+00 5.000e+00 6.250e+02        1.
a3114 a3115              1 1.250e+01 1.250e+01 2.500e+02
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a4114 a3114              1 5.000e+00 5.000e+00 6.250e+02        1.
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a2115 *  54              1 1.250e+01 0.000e+00 2.500e+02
a2115 a1115              1 5.000e+00 5.000e+00 6.250e+02        1.
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a4115 a3115              1 5.000e+00 5.000e+00 6.250e+02        1.
a1116 *  57              1 1.250e+01 0.000e+00 2.500e+02
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a2116 *  59              1 1.250e+01 0.000e+00 2.500e+02
a2116 *  60              1 1.250e+01 0.000e+00 2.500e+02
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a3116 *  61              1 1.250e+01 0.000e+00 2.500e+02
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a3116 a2116              1 5.000e+00 5.000e+00 6.250e+02        1.
a4116 *  63              1 1.250e+01 0.000e+00 2.500e+02
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a4116 a3116              1 5.000e+00 5.000e+00 6.250e+02        1.
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filename: SEGMT

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 25   0   0    0  0  a11 1    *   2
  0   0   0   25  0  a21 1    *   3
  0  25  25   25  1  a21 1    a21 2
 25  25  25    0  1  a21 1    a21 5
 25   0   0    0  0  a21 1    *   4
  0   0   0   25  0  a31 1    *   5
  0  25  25   25  1  a31 1    a31 2
 25  25  25    0  1  a31 1    a31 5
 25   0   0    0  0  a31 1    *   6
  0   0   0   25  0  a41 1    *   7
  0  25  25   25  1  a41 1    a41 2
 25  25  25    0  1  a41 1    a41 5
 25   0   0    0  0  a41 1    *   8
  0  25   0   50  0  a11 2    *   9
  0  50  25   50  1  a11 2    a11 3
 25  50  25   25  1  a11 2    a11 6
 25  25   0   25  0  a11 2    a11 1
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  0  50  25   50  1  a21 2    a21 3
 25  50  25   25  1  a21 2    a21 6
 25  25   0   25  0  a21 2    a21 1
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  0  50  25   50  1  a31 2    a31 3
 25  50  25   25  1  a31 2    a31 6
 25  25   0   25  0  a31 2    a31 1
  0  25   0   50  0  a41 2    *  12
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 25  75  25   50  1  a21 3    a21 7
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  0  50   0   75  0  a31 3    *  15
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 25  75  25   50  1  a31 3    a31 7
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 25 100  25   75  1  a21 4    a21 8
 25  75   0   75  0  a21 4    a21 3
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  0 100  25  100  0  a31 4    *  21
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  0  75   0  100  0  a31 4    *  22
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 25 100  25   75  1  a41 4    a41 8
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  0  75   0  100  0  a41 4    *  24
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50	50	50	75	0	a4111	a41 7
50	75	75	75	1	a4111	a4112
75	75	75	50	1	a4111	a4115
75	50	50	50	0	a4111	a4110
75	75	50	75	0	a1112	a1111
50	75	50	100	0	a1112	a11 8
50	100	75	100	0	a1112	* 37
75	100	75	75	1	a1112	a1116
75	75	50	75	0	a2112	a2111
50	75	50	100	0	a2112	a21 8
50	100	75	100	0	a2112	* 38
75	100	75	75	1	a2112	a2116
75	75	50	75	0	a3112	a3111
50	75	50	100	0	a3112	a31 8
50	100	75	100	0	a3112	* 39
75	100	75	75	1	a3112	a3116
75	75	50	75	0	a4112	a4111
50	75	50	100	0	a4112	a41 8
50	100	75	100	0	a4112	* 40
75	100	75	75	1	a4112	a4116
100	0	75	0	0	a1113	* 41
75	0	75	25	0	a1113	a11 9
75	25	100	25	1	a1113	a1114
100	25	100	0	0	a1113	* 42
100	0	75	0	0	a2113	* 43
75	0	75	25	0	a2113	a21 9
75	25	100	25	1	a2113	a2114
100	25	100	0	0	a2113	* 44
100	0	75	0	0	a3113	* 45
75	0	75	25	0	a3113	a31 9
75	25	100	25	1	a3113	a3114
100	25	100	0	0	a3113	* 46
100	0	75	0	0	a4113	* 47
75	0	75	25	0	a4113	a41 9
75	25	100	25	1	a4113	a4114
100	25	100	0	0	a4113	* 48
75	25	75	50	0	a1114	a1110
75	50	100	50	1	a1114	a1115
100	50	100	25	0	a1114	* 49
100	25	75	25	0	a1114	a1113
75	25	75	50	0	a2114	a2110
75	50	100	50	1	a2114	a2115
100	50	100	25	0	a2114	* 50
100	25	75	25	0	a2114	a2113
75	25	75	50	0	a3114	a3110
75	50	100	50	1	a3114	a3115
100	50	100	25	0	a3114	* 51
100	25	75	25	0	a3114	a3113
75	25	75	50	0	a4114	a4110

75	50	100	50	1	a4114	a4115
100	50	100	25	0	a4114	* 52
100	25	75	25	0	a4114	a4113
100	50	75	50	0	a1115	a1114
75	50	75	75	0	a1115	a1111
75	75	100	75	1	a1115	a1116
100	75	100	50	0	a1115	* 53
100	50	75	50	0	a2115	a2114
75	50	75	75	0	a2115	a2111
75	75	100	75	1	a2115	a2116
100	75	100	50	0	a2115	* 54
100	50	75	50	0	a3115	a3114
75	50	75	75	0	a3115	a3111
75	75	100	75	1	a3115	a3116
100	75	100	50	0	a3115	* 55
100	50	75	50	0	a4115	a4114
75	50	75	75	0	a4115	a4111
75	75	100	75	1	a4115	a4116
100	75	100	50	0	a4115	* 56
100	100	100	75	0	a1116	* 57
100	75	75	75	0	a1116	a1115
75	75	75	100	0	a1116	a1112
75	100	100	100	0	a1116	* 58
100	100	100	75	0	a2116	* 59
100	75	75	75	0	a2116	a2115
75	75	75	100	0	a2116	a2112
75	100	100	100	0	a2116	* 60
100	100	100	75	0	a3116	* 61
100	75	75	75	0	a3116	a3115
75	75	75	100	0	a3116	a3112
75	100	100	100	0	a3116	* 62
100	100	100	75	0	a4116	* 63
100	75	75	75	0	a4116	a4115
75	75	75	100	0	a4116	a4112
75	100	100	100	0	a4116	* 64

Example 3.3.5 Uniform 3D grid spacing in a rectangular domain, layers slope 10° in x-direction and 10° in y-direction

Test Case and Expected Output as Provided in the AMESH User's Manual

filename: IN

```
locat
a11 1 101     12.5000000000  12.5000000000  50.00000       10.0000
a21 1 102     12.5000000000  12.5000000000  40.00000       10.0000
a31 1 103     12.5000000000  12.5000000000  30.00000       10.0000
a41 1 104     12.5000000000  12.5000000000  20.00000       10.0000
a11 2 101     12.5000000000  37.5000000000  45.59183       10.0000
a21 2 102     12.5000000000  37.5000000000  35.59183       10.0000
a31 2 103     12.5000000000  37.5000000000  25.59183       10.0000
a41 2 104     12.5000000000  37.5000000000  15.59183       10.0000
a11 3 101     12.5000000000  62.5000000000  41.18365       10.0000
a21 3 102     12.5000000000  62.5000000000  31.18365       10.0000
a31 3 103     12.5000000000  62.5000000000  21.18365       10.0000
a41 3 104     12.5000000000  62.5000000000  11.18365       10.0000
a11 4 101     12.5000000000  87.5000000000  36.77548       10.0000
a21 4 102     12.5000000000  87.5000000000  26.77548       10.0000
a31 4 103     12.5000000000  87.5000000000  16.77548       10.0000
a41 4 104     12.5000000000  87.5000000000   6.77548       10.0000
a11 5 101     37.5000000000  12.5000000000  45.59183       10.0000
a21 5 102     37.5000000000  12.5000000000  35.59183       10.0000
a31 5 103     37.5000000000  12.5000000000  25.59183       10.0000
a41 5 104     37.5000000000  12.5000000000  15.59183       10.0000
a11 6 101     37.5000000000  37.5000000000  41.18365       10.0000
a21 6 102     37.5000000000  37.5000000000  31.18365       10.0000
a31 6 103     37.5000000000  37.5000000000  21.18365       10.0000
a41 6 104     37.5000000000  37.5000000000  11.18365       10.0000
a11 7 101     37.5000000000  62.5000000000  36.77548       10.0000
a21 7 102     37.5000000000  62.5000000000  26.77548       10.0000
a31 7 103     37.5000000000  62.5000000000  16.77548       10.0000
a41 7 104     37.5000000000  62.5000000000   6.77548       10.0000
a11 8 101     37.5000000000  87.5000000000  32.36730       10.0000
a21 8 102     37.5000000000  87.5000000000  22.36730       10.0000
a31 8 103     37.5000000000  87.5000000000  12.36730       10.0000
a41 8 104     37.5000000000  87.5000000000   2.36730       10.0000
a11 9 101     62.5000000000  12.5000000000  41.18365       10.0000
a21 9 102     62.5000000000  12.5000000000  31.18365       10.0000
a31 9 103     62.5000000000  12.5000000000  21.18365       10.0000
a41 9 104     62.5000000000  12.5000000000  11.18365       10.0000
a1110 101     62.5000000000  37.5000000000  36.77548       10.0000
a2110 102     62.5000000000  37.5000000000  26.77548       10.0000
a3110 103     62.5000000000  37.5000000000  16.77548       10.0000
a4110 104     62.5000000000  37.5000000000   6.77548       10.0000
a1111 101     62.5000000000  62.5000000000  32.36730       10.0000
a2111 102     62.5000000000  62.5000000000  22.36730       10.0000
a3111 103     62.5000000000  62.5000000000  12.36730       10.0000
a4111 104     62.5000000000  62.5000000000   2.36730       10.0000
a1112 101     62.5000000000  87.5000000000  27.95913       10.0000
a2112 102     62.5000000000  87.5000000000  17.95913       10.0000
a3112 103     62.5000000000  87.5000000000   7.95913       10.0000
a4112 104     62.5000000000  87.5000000000  -2.04087       10.0000
a1113 101     87.5000000000  12.5000000000  36.77548       10.0000
a2113 102     87.5000000000  12.5000000000  26.77548       10.0000
a3113 103     87.5000000000  12.5000000000  16.77548       10.0000
a4113 104     87.5000000000  12.5000000000   6.77548       10.0000
a1114 101     87.5000000000  37.5000000000  32.36730       10.0000
a2114 102     87.5000000000  37.5000000000  22.36730       10.0000
a3114 103     87.5000000000  37.5000000000  12.36730       10.0000
a4114 104     87.5000000000  37.5000000000   2.36730       10.0000
a1115 101     87.5000000000  62.5000000000  27.95913       10.0000
a2115 102     87.5000000000  62.5000000000  17.95913       10.0000
a3115 103     87.5000000000  62.5000000000   7.95913       10.0000
a4115 104     87.5000000000  62.5000000000  -2.04087       10.0000
a1116 101     87.5000000000  87.5000000000  23.55095       10.0000
a2116 102     87.5000000000  87.5000000000  13.55095       10.0000
a3116 103     87.5000000000  87.5000000000   3.55095       10.0000
a4116 104     87.5000000000  87.5000000000  -6.44905       10.0000
```

```
bound
0.0    0.0
0.0    100.0
100.0  100.0
100.0  0.0

toler
0.5
```

filename: ELEME

```
eleme
a11 1  rock1   6.250e+03      12.500  12.500  50.0000
a21 1  rock1   6.250e+03      12.500  12.500  40.0000
a31 1  rock1   6.250e+03      12.500  12.500  30.0000
a41 1  rock1   6.250e+03      12.500  12.500  20.0000
a11 2  rock1   6.250e+03      12.500  37.500  45.5918
a21 2  rock1   6.250e+03      12.500  37.500  35.5918
a31 2  rock1   6.250e+03      12.500  37.500  25.5918
a41 2  rock1   6.250e+03      12.500  37.500  15.5918
a11 3  rock1   6.250e+03      12.500  62.500  41.1837
a21 3  rock1   6.250e+03      12.500  62.500  31.1837
a31 3  rock1   6.250e+03      12.500  62.500  21.1837
a41 3  rock1   6.250e+03      12.500  62.500  11.1837
a11 4  rock1   6.250e+03      12.500  87.500  36.7755
a21 4  rock1   6.250e+03      12.500  87.500  26.7755
a31 4  rock1   6.250e+03      12.500  87.500  16.7755
a41 4  rock1   6.250e+03      12.500  87.500  6.7755
a11 5  rock1   6.250e+03      37.500  12.500  45.5918
a21 5  rock1   6.250e+03      37.500  12.500  35.5918
a31 5  rock1   6.250e+03      37.500  12.500  25.5918
a41 5  rock1   6.250e+03      37.500  12.500  15.5918
....
a1113  rock1   6.250e+03      87.500  12.500  36.7755
a2113  rock1   6.250e+03      87.500  12.500  26.7755
a3113  rock1   6.250e+03      87.500  12.500  16.7755
a4113  rock1   6.250e+03      87.500  12.500  6.7755
a1114  rock1   6.250e+03      87.500  37.500  32.3673
a2114  rock1   6.250e+03      87.500  37.500  22.3673
a3114  rock1   6.250e+03      87.500  37.500  12.3673
a4114  rock1   6.250e+03      87.500  37.500  2.3673
a1115  rock1   6.250e+03      87.500  62.500  27.9591
a2115  rock1   6.250e+03      87.500  62.500  17.9591
a3115  rock1   6.250e+03      87.500  62.500  7.9591
a4115  rock1   6.250e+03      87.500  62.500  -2.0409
a1116  rock1   6.250e+03      87.500  87.500  23.5510
a2116  rock1   6.250e+03      87.500  87.500  13.5510
a3116  rock1   6.250e+03      87.500  87.500  3.5509
a4116  rock1   6.250e+03      87.500  87.500  -6.4490
```

filename: CONNE

```
conne
a11 1  a11 2   1       1.250e+01       1.250e+01       2.500e+02       -1.736e-01
a11 1  a11 5   1       1.250e+01       1.250e+01       2.500e+02       -1.736e-01
a21 1  a21 2   1       1.250e+01       1.250e+01       2.500e+02       -1.736e-01
a21 1  a21 5   1       1.250e+01       1.250e+01       2.500e+02       -1.736e-01
a21 1  a11 1   1       5.000e+00       5.000e+00       6.250e+02       1.
a31 1  a31 2   1       1.250e+01       1.250e+01       2.500e+02       -1.736e-01
a31 1  a31 5   1       1.250e+01       1.250e+01       2.500e+02       -1.736e-01
a31 1  a21 1   1       5.000e+00       5.000e+00       6.250e+02       1.
a41 1  a41 2   1       1.250e+01       1.250e+01       2.500e+02       -1.736e-01
a41 1  a41 5   1       1.250e+01       1.250e+01       2.500e+02       -1.736e-01
a41 1  a31 1   1       5.000e+00       5.000e+00       6.250e+02       1.
a11 2  a11 3   1       1.250e+01       1.250e+01       2.500e+02       -1.736e-01
a11 2  a11 6   1       1.250e+01       1.250e+01       2.500e+02       -1.736e-01
a21 2  a21 3   1       1.250e+01       1.250e+01       2.500e+02       -1.736e-01
a21 2  a21 6   1       1.250e+01       1.250e+01       2.500e+02       -1.736e-01
a21 2  a11 2   1       5.000e+00       5.000e+00       6.250e+02       1.
a31 2  a31 3   1       1.250e+01       1.250e+01       2.500e+02       -1.736e-01
a31 2  a31 6   1       1.250e+01       1.250e+01       2.500e+02       -1.736e-01
a31 2  a21 2   1       5.000e+00       5.000e+00       6.250e+02       1.
a41 2  a41 3   1       1.250e+01       1.250e+01       2.500e+02       -1.736e-01
a41 2  a41 6   1       1.250e+01       1.250e+01       2.500e+02       -1.736e-01
a41 2  a31 2   1       5.000e+00       5.000e+00       6.250e+02       1.
a11 3  a11 4   1       1.250e+01       1.250e+01       2.500e+02       -1.736e-01
a11 3  a11 7   1       1.250e+01       1.250e+01       2.500e+02       -1.736e-01
a21 3  a21 4   1       1.250e+01       1.250e+01       2.500e+02       -1.736e-01
....
a3114  a2114   1       5.000e+00       5.000e+00       6.250e+02       1.
a4114  a4115   1       1.250e+01       1.250e+01       2.500e+02       -1.736e-01
a4114  a3114   1       5.000e+00       5.000e+00       6.250e+02       1.
a1115  a1116   1       1.250e+01       1.250e+01       2.500e+02       -1.736e-01
a2115  a2116   1       1.250e+01       1.250e+01       2.500e+02       -1.736e-01
a2115  a1115   1       5.000e+00       5.000e+00       6.250e+02       1.
a3115  a3116   1       1.250e+01       1.250e+01       2.500e+02       -1.736e-01
a3115  a2115   1       5.000e+00       5.000e+00       6.250e+02       1.
a4115  a4116   1       1.250e+01       1.250e+01       2.500e+02       -1.736e-01
a4115  a3115   1       5.000e+00       5.000e+00       6.250e+02       1.
a2116  a1116   1       5.000e+00       5.000e+00       6.250e+02       1.
a3116  a2116   1       5.000e+00       5.000e+00       6.250e+02       1.
a4116  a3116   1       5.000e+00       5.000e+00       6.250e+02       1.
```

Note that the author of the AMESH User's Manual doesn't provided expected output from file SEGMT for this test case.

Example 3.3.5 Uniform 3D grid spacing in a rectangular domain, layers slope 10° in x-direction and 10° in y-direction

Acceptance Test: Results Generated by AMESH

filename: IN

```
locat
a11 1 101     12.5000000000  12.5000000000  50.00000       10.0000
a21 1 102     12.5000000000  12.5000000000  40.00000       10.0000
a31 1 103     12.5000000000  12.5000000000  30.00000       10.0000
a41 1 104     12.5000000000  12.5000000000  20.00000       10.0000
a11 2 101     12.5000000000  37.5000000000  45.59183       10.0000
a21 2 102     12.5000000000  37.5000000000  35.59183       10.0000
a31 2 103     12.5000000000  37.5000000000  25.59183       10.0000
a41 2 104     12.5000000000  37.5000000000  15.59183       10.0000
a11 3 101     12.5000000000  62.5000000000  41.18365       10.0000
a21 3 102     12.5000000000  62.5000000000  31.18365       10.0000
a31 3 103     12.5000000000  62.5000000000  21.18365       10.0000
a41 3 104     12.5000000000  62.5000000000  11.18365       10.0000
a11 4 101     12.5000000000  87.5000000000  36.77548       10.0000
a21 4 102     12.5000000000  87.5000000000  26.77548       10.0000
a31 4 103     12.5000000000  87.5000000000  16.77548       10.0000
a41 4 104     12.5000000000  87.5000000000   6.77548       10.0000
a11 5 101     37.5000000000  12.5000000000  45.59183       10.0000
a21 5 102     37.5000000000  12.5000000000  35.59183       10.0000
a31 5 103     37.5000000000  12.5000000000  25.59183       10.0000
a41 5 104     37.5000000000  12.5000000000  15.59183       10.0000
a11 6 101     37.5000000000  37.5000000000  41.18365       10.0000
a21 6 102     37.5000000000  37.5000000000  31.18365       10.0000
a31 6 103     37.5000000000  37.5000000000  21.18365       10.0000
a41 6 104     37.5000000000  37.5000000000  11.18365       10.0000
a11 7 101     37.5000000000  62.5000000000  36.77548       10.0000
a21 7 102     37.5000000000  62.5000000000  26.77548       10.0000
a31 7 103     37.5000000000  62.5000000000  16.77548       10.0000
a41 7 104     37.5000000000  62.5000000000   6.77548       10.0000
a11 8 101     37.5000000000  87.5000000000  32.36730       10.0000
a21 8 102     37.5000000000  87.5000000000  22.36730       10.0000
a31 8 103     37.5000000000  87.5000000000  12.36730       10.0000
a41 8 104     37.5000000000  87.5000000000   2.36730       10.0000
a11 9 101     62.5000000000  12.5000000000  41.18365       10.0000
a21 9 102     62.5000000000  12.5000000000  31.18365       10.0000
a31 9 103     62.5000000000  12.5000000000  21.18365       10.0000
a41 9 104     62.5000000000  12.5000000000  11.18365       10.0000
a1110 101     62.5000000000  37.5000000000  36.77548       10.0000
a2110 102     62.5000000000  37.5000000000  26.77548       10.0000
a3110 103     62.5000000000  37.5000000000  16.77548       10.0000
a4110 104     62.5000000000  37.5000000000   6.77548       10.0000
a1111 101     62.5000000000  62.5000000000  32.36730       10.0000
a2111 102     62.5000000000  62.5000000000  22.36730       10.0000
a3111 103     62.5000000000  62.5000000000  12.36730       10.0000
a4111 104     62.5000000000  62.5000000000   2.36730       10.0000
a1112 101     62.5000000000  87.5000000000  27.95913       10.0000
a2112 102     62.5000000000  87.5000000000  17.95913       10.0000
a3112 103     62.5000000000  87.5000000000   7.95913       10.0000
a4112 104     62.5000000000  87.5000000000  -2.04087       10.0000
a1113 101     87.5000000000  12.5000000000  36.77548       10.0000
a2113 102     87.5000000000  12.5000000000  26.77548       10.0000
a3113 103     87.5000000000  12.5000000000  16.77548       10.0000
a4113 104     87.5000000000  12.5000000000   6.77548       10.0000
a1114 101     87.5000000000  37.5000000000  32.36730       10.0000
a2114 102     87.5000000000  37.5000000000  22.36730       10.0000
a3114 103     87.5000000000  37.5000000000  12.36730       10.0000
a4114 104     87.5000000000  37.5000000000   2.36730       10.0000
a1115 101     87.5000000000  62.5000000000  27.95913       10.0000
a2115 102     87.5000000000  62.5000000000  17.95913       10.0000
a3115 103     87.5000000000  62.5000000000   7.95913       10.0000
a4115 104     87.5000000000  62.5000000000  -2.04087       10.0000
a1116 101     87.5000000000  87.5000000000  23.55095       10.0000
a2116 102     87.5000000000  87.5000000000  13.55095       10.0000
a3116 103     87.5000000000  87.5000000000   3.55095       10.0000
a4116 104     87.5000000000  87.5000000000  -6.44905       10.0000
```

```
bound
0.0   0.0
0.0   100.0
100.0 100.0
100.0 0.0

toler
0.5
```

filename: ELEME

```
eleme
a11 1          rock1 6.250e+03          12.500      12.500      50.0000
a21 1          rock1 6.250e+03          12.500      12.500      40.0000
a31 1          rock1 6.250e+03          12.500      12.500      30.0000
a41 1          rock1 6.250e+03          12.500      12.500      20.0000
a11 2          rock1 6.250e+03          12.500      37.500      45.5918
a21 2          rock1 6.250e+03          12.500      37.500      35.5918
a31 2          rock1 6.250e+03          12.500      37.500      25.5918
a41 2          rock1 6.250e+03          12.500      37.500      15.5918
a11 3          rock1 6.250e+03          12.500      62.500      41.1837
a21 3          rock1 6.250e+03          12.500      62.500      31.1837
a31 3          rock1 6.250e+03          12.500      62.500      21.1837
a41 3          rock1 6.250e+03          12.500      62.500      11.1837
a11 4          rock1 6.250e+03          12.500      87.500      36.7755
a21 4          rock1 6.250e+03          12.500      87.500      26.7755
a31 4          rock1 6.250e+03          12.500      87.500      16.7755
a41 4          rock1 6.250e+03          12.500      87.500       6.7755
a11 5          rock1 6.250e+03          37.500      12.500      45.5918
a21 5          rock1 6.250e+03          37.500      12.500      35.5918
a31 5          rock1 6.250e+03          37.500      12.500      25.5918
a41 5          rock1 6.250e+03          37.500      12.500      15.5918
a11 6          rock1 6.250e+03          37.500      37.500      41.1837
a21 6          rock1 6.250e+03          37.500      37.500      31.1837
a31 6          rock1 6.250e+03          37.500      37.500      21.1837
a41 6          rock1 6.250e+03          37.500      37.500      11.1837
a11 7          rock1 6.250e+03          37.500      62.500      36.7755
a21 7          rock1 6.250e+03          37.500      62.500      26.7755
a31 7          rock1 6.250e+03          37.500      62.500      16.7755
a41 7          rock1 6.250e+03          37.500      62.500       6.7755
a11 8          rock1 6.250e+03          37.500      87.500      32.3673
a21 8          rock1 6.250e+03          37.500      87.500      22.3673
a31 8          rock1 6.250e+03          37.500      87.500      12.3673
a41 8          rock1 6.250e+03          37.500      87.500       2.3673
a11 9          rock1 6.250e+03          62.500      12.500      41.1837
a21 9          rock1 6.250e+03          62.500      12.500      31.1837
a31 9          rock1 6.250e+03          62.500      12.500      21.1837
a41 9          rock1 6.250e+03          62.500      12.500      11.1837
a1110          rock1 6.250e+03          62.500      37.500      36.7755
a2110          rock1 6.250e+03          62.500      37.500      26.7755
a3110          rock1 6.250e+03          62.500      37.500      16.7755
a4110          rock1 6.250e+03          62.500      37.500       6.7755
a1111          rock1 6.250e+03          62.500      62.500      32.3673
a2111          rock1 6.250e+03          62.500      62.500      22.3673
a3111          rock1 6.250e+03          62.500      62.500      12.3673
a4111          rock1 6.250e+03          62.500      62.500       2.3673
a1112          rock1 6.250e+03          62.500      87.500      27.9591
a2112          rock1 6.250e+03          62.500      87.500      17.9591
a3112          rock1 6.250e+03          62.500      87.500       7.9591
a4112          rock1 6.250e+03          62.500      87.500      -2.0409
a1113          rock1 6.250e+03          87.500      12.500      36.7755
a2113          rock1 6.250e+03          87.500      12.500      26.7755
a3113          rock1 6.250e+03          87.500      12.500      16.7755
a4113          rock1 6.250e+03          87.500      12.500       6.7755
a1114          rock1 6.250e+03          87.500      37.500      32.3673
a2114          rock1 6.250e+03          87.500      37.500      22.3673
a3114          rock1 6.250e+03          87.500      37.500      12.3673
a4114          rock1 6.250e+03          87.500      37.500       2.3673
a1115          rock1 6.250e+03          87.500      62.500      27.9591
a2115          rock1 6.250e+03          87.500      62.500      17.9591
a3115          rock1 6.250e+03          87.500      62.500       7.9591
a4115          rock1 6.250e+03          87.500      62.500      -2.0409
a1116          rock1 6.250e+03          87.500      87.500      23.5510
a2116          rock1 6.250e+03          87.500      87.500      13.5510
a3116          rock1 6.250e+03          87.500      87.500       3.5509
a4116          rock1 6.250e+03          87.500      87.500      -6.4490
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filename: CONNE

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conne
a11 1 *   1                1 1.250e+01 0.000e+00 2.500e+02
a11 1 a11 2                1 1.250e+01 1.250e+01 2.500e+02       -1.736e-01
a11 1 a11 5                1 1.250e+01 1.250e+01 2.500e+02       -1.736e-01
a11 1 *   2                1 1.250e+01 0.000e+00 2.500e+02
a21 1 *   3                1 1.250e+01 0.000e+00 2.500e+02
a21 1 a21 2                1 1.250e+01 1.250e+01 2.500e+02       -1.736e-01
a21 1 a21 5                1 1.250e+01 1.250e+01 2.500e+02       -1.736e-01
a21 1 *   4                1 1.250e+01 0.000e+00 2.500e+02
a21 1 a11 1                1 5.000e+00 5.000e+00 6.250e+02        1.
a31 1 *   5                1 1.250e+01 0.000e+00 2.500e+02
a31 1 a31 2                1 1.250e+01 1.250e+01 2.500e+02       -1.736e-01
a31 1 a31 5                1 1.250e+01 1.250e+01 2.500e+02       -1.736e-01
a31 1 *   6                1 1.250e+01 0.000e+00 2.500e+02
a31 1 a21 1                1 5.000e+00 5.000e+00 6.250e+02        1.
a41 1 *   7                1 1.250e+01 0.000e+00 2.500e+02
a41 1 a41 2                1 1.250e+01 1.250e+01 2.500e+02       -1.736e-01
a41 1 a41 5                1 1.250e+01 1.250e+01 2.500e+02       -1.736e-01
a41 1 *   8                1 1.250e+01 0.000e+00 2.500e+02
a41 1 a31 1                1 5.000e+00 5.000e+00 6.250e+02        1.
a11 2 *   9                1 1.250e+01 0.000e+00 2.500e+02
a11 2 a11 3                1 1.250e+01 1.250e+01 2.500e+02       -1.736e-01
a11 2 a11 6                1 1.250e+01 1.250e+01 2.500e+02       -1.736e-01
a21 2 *  10                1 1.250e+01 0.000e+00 2.500e+02
a21 2 a21 3                1 1.250e+01 1.250e+01 2.500e+02       -1.736e-01
a21 2 a21 6                1 1.250e+01 1.250e+01 2.500e+02       -1.736e-01
a21 2 a11 2                1 5.000e+00 5.000e+00 6.250e+02        1.
a31 2 *  11                1 1.250e+01 0.000e+00 2.500e+02
a31 2 a31 3                1 1.250e+01 1.250e+01 2.500e+02       -1.736e-01
a31 2 a31 6                1 1.250e+01 1.250e+01 2.500e+02       -1.736e-01
a31 2 a21 2                1 5.000e+00 5.000e+00 6.250e+02        1.
a41 2 *  12                1 1.250e+01 0.000e+00 2.500e+02
a41 2 a41 3                1 1.250e+01 1.250e+01 2.500e+02       -1.736e-01
a41 2 a41 6                1 1.250e+01 1.250e+01 2.500e+02       -1.736e-01
a41 2 a31 2                1 5.000e+00 5.000e+00 6.250e+02        1.
a11 3 *  13                1 1.250e+01 0.000e+00 2.500e+02
a11 3 a11 4                1 1.250e+01 1.250e+01 2.500e+02       -1.736e-01
a11 3 a11 7                1 1.250e+01 1.250e+01 2.500e+02       -1.736e-01
a21 3 *  14                1 1.250e+01 0.000e+00 2.500e+02
a21 3 a21 4                1 1.250e+01 1.250e+01 2.500e+02       -1.736e-01
a21 3 a21 7                1 1.250e+01 1.250e+01 2.500e+02       -1.736e-01
a21 3 a11 3                1 5.000e+00 5.000e+00 6.250e+02        1.
a31 3 *  15                1 1.250e+01 0.000e+00 2.500e+02
a31 3 a31 4                1 1.250e+01 1.250e+01 2.500e+02       -1.736e-01
a31 3 a31 7                1 1.250e+01 1.250e+01 2.500e+02       -1.736e-01
a31 3 a21 3                1 5.000e+00 5.000e+00 6.250e+02        1.
a41 3 *  16                1 1.250e+01 0.000e+00 2.500e+02
a41 3 a41 4                1 1.250e+01 1.250e+01 2.500e+02       -1.736e-01
a41 3 a41 7                1 1.250e+01 1.250e+01 2.500e+02       -1.736e-01
a41 3 a31 3                1 5.000e+00 5.000e+00 6.250e+02        1.
a11 4 *  17                1 1.250e+01 0.000e+00 2.500e+02
a11 4 a11 8                1 1.250e+01 1.250e+01 2.500e+02       -1.736e-01
a11 4 *  18                1 1.250e+01 0.000e+00 2.500e+02
a21 4 *  19                1 1.250e+01 0.000e+00 2.500e+02
a21 4 a21 8                1 1.250e+01 1.250e+01 2.500e+02       -1.736e-01
a21 4 *  20                1 1.250e+01 0.000e+00 2.500e+02
a21 4 a11 4                1 5.000e+00 5.000e+00 6.250e+02        1.
a31 4 *  21                1 1.250e+01 0.000e+00 2.500e+02
a31 4 a31 8                1 1.250e+01 1.250e+01 2.500e+02       -1.736e-01
a31 4 *  22                1 1.250e+01 0.000e+00 2.500e+02
a31 4 a21 4                1 5.000e+00 5.000e+00 6.250e+02        1.
a41 4 *  23                1 1.250e+01 0.000e+00 2.500e+02
a41 4 a41 8                1 1.250e+01 1.250e+01 2.500e+02       -1.736e-01
a41 4 *  24                1 1.250e+01 0.000e+00 2.500e+02
a41 4 a31 4                1 5.000e+00 5.000e+00 6.250e+02        1.
a11 5 a11 6                1 1.250e+01 1.250e+01 2.500e+02       -1.736e-01
a11 5 a11 9                1 1.250e+01 1.250e+01 2.500e+02       -1.736e-01
a11 5 *  25                1 1.250e+01 0.000e+00 2.500e+02
a21 5 a21 6                1 1.250e+01 1.250e+01 2.500e+02       -1.736e-01
a21 5 a21 9                1 1.250e+01 1.250e+01 2.500e+02       -1.736e-01
a21 5 *  26                1 1.250e+01 0.000e+00 2.500e+02
a21 5 a11 5                1 5.000e+00 5.000e+00 6.250e+02        1.
a31 5 a31 6                1 1.250e+01 1.250e+01 2.500e+02       -1.736e-01
a31 5 a31 9                1 1.250e+01 1.250e+01 2.500e+02       -1.736e-01
a31 5 *  27                1 1.250e+01 0.000e+00 2.500e+02
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a31 5 a21 5          1 5.000e+00 5.000e+00 6.250e+02  1.
a41 5 a41 6          1 1.250e+01 1.250e+01 2.500e+02 -1.736e-01
a41 5 a41 9          1 1.250e+01 1.250e+01 2.500e+02 -1.736e-01
a41 5 *  28         1 1.250e+01 0.000e+00 2.500e+02
a41 5 a31 5          1 5.000e+00 5.000e+00 6.250e+02  1.
a11 6 a11 7          1 1.250e+01 1.250e+01 2.500e+02 -1.736e-01
a11 6 a1110          1 1.250e+01 1.250e+01 2.500e+02 -1.736e-01
a21 6 a21 7          1 1.250e+01 1.250e+01 2.500e+02 -1.736e-01
a21 6 a2110          1 1.250e+01 1.250e+01 2.500e+02 -1.736e-01
a21 6 a11 6          1 5.000e+00 5.000e+00 6.250e+02  1.
a31 6 a31 7          1 1.250e+01 1.250e+01 2.500e+02 -1.736e-01
a31 6 a3110          1 1.250e+01 1.250e+01 2.500e+02 -1.736e-01
a31 6 a21 6          1 5.000e+00 5.000e+00 6.250e+02  1.
a41 6 a41 7          1 1.250e+01 1.250e+01 2.500e+02 -1.736e-01
a41 6 a4110          1 1.250e+01 1.250e+01 2.500e+02 -1.736e-01
a41 6 a31 6          1 5.000e+00 5.000e+00 6.250e+02  1.
a11 7 a11 8          1 1.250e+01 1.250e+01 2.500e+02 -1.736e-01
a11 7 a1111          1 1.250e+01 1.250e+01 2.500e+02 -1.736e-01
a21 7 a21 8          1 1.250e+01 1.250e+01 2.500e+02 -1.736e-01
a21 7 a2111          1 1.250e+01 1.250e+01 2.500e+02 -1.736e-01
a21 7 a11 7          1 5.000e+00 5.000e+00 6.250e+02  1.
a31 7 a31 8          1 1.250e+01 1.250e+01 2.500e+02 -1.736e-01
a31 7 a3111          1 1.250e+01 1.250e+01 2.500e+02 -1.736e-01
a31 7 a21 7          1 5.000e+00 5.000e+00 6.250e+02  1.
a41 7 a41 8          1 1.250e+01 1.250e+01 2.500e+02 -1.736e-01
a41 7 a4111          1 1.250e+01 1.250e+01 2.500e+02 -1.736e-01
a41 7 a31 7          1 5.000e+00 5.000e+00 6.250e+02  1.
a11 8 *  29         1 1.250e+01 0.000e+00 2.500e+02
a11 8 a1112          1 1.250e+01 1.250e+01 2.500e+02 -1.736e-01
a21 8 *  30         1 1.250e+01 0.000e+00 2.500e+02
a21 8 a2112          1 1.250e+01 1.250e+01 2.500e+02 -1.736e-01
a21 8 a11 8          1 5.000e+00 5.000e+00 6.250e+02  1.
a31 8 *  31         1 1.250e+01 0.000e+00 2.500e+02
a31 8 a3112          1 1.250e+01 1.250e+01 2.500e+02 -1.736e-01
a31 8 a21 8          1 5.000e+00 5.000e+00 6.250e+02  1.
a41 8 *  32         1 1.250e+01 0.000e+00 2.500e+02
a41 8 a4112          1 1.250e+01 1.250e+01 2.500e+02 -1.736e-01
a41 8 a31 8          1 5.000e+00 5.000e+00 6.250e+02  1.
a11 9 a1110          1 1.250e+01 1.250e+01 2.500e+02 -1.736e-01
a11 9 a1113          1 1.250e+01 1.250e+01 2.500e+02 -1.736e-01
a11 9 *  33         1 1.250e+01 0.000e+00 2.500e+02
a21 9 a2110          1 1.250e+01 1.250e+01 2.500e+02 -1.736e-01
a21 9 a2113          1 1.250e+01 1.250e+01 2.500e+02 -1.736e-01
a21 9 *  34         1 1.250e+01 0.000e+00 2.500e+02
a21 9 a11 9          1 5.000e+00 5.000e+00 6.250e+02  1.
a31 9 a3110          1 1.250e+01 1.250e+01 2.500e+02 -1.736e-01
a31 9 a3113          1 1.250e+01 1.250e+01 2.500e+02 -1.736e-01
a31 9 *  35         1 1.250e+01 0.000e+00 2.500e+02
a31 9 a21 9          1 5.000e+00 5.000e+00 6.250e+02  1.
a41 9 a4110          1 1.250e+01 1.250e+01 2.500e+02 -1.736e-01
a41 9 a4113          1 1.250e+01 1.250e+01 2.500e+02 -1.736e-01
a41 9 *  36         1 1.250e+01 0.000e+00 2.500e+02
a41 9 a31 9          1 5.000e+00 5.000e+00 6.250e+02  1.
a1110 a1111          1 1.250e+01 1.250e+01 2.500e+02 -1.736e-01
a1110 a1114          1 1.250e+01 1.250e+01 2.500e+02 -1.736e-01
a2110 a2111          1 1.250e+01 1.250e+01 2.500e+02 -1.736e-01
a2110 a2114          1 1.250e+01 1.250e+01 2.500e+02 -1.736e-01
a2110 a1110          1 5.000e+00 5.000e+00 6.250e+02  1.
a3110 a3111          1 1.250e+01 1.250e+01 2.500e+02 -1.736e-01
a3110 a3114          1 1.250e+01 1.250e+01 2.500e+02 -1.736e-01
a3110 a2110          1 5.000e+00 5.000e+00 6.250e+02  1.
a4110 a4111          1 1.250e+01 1.250e+01 2.500e+02 -1.736e-01
a4110 a4114          1 1.250e+01 1.250e+01 2.500e+02 -1.736e-01
a4110 a3110          1 5.000e+00 5.000e+00 6.250e+02  1.
a1111 a1112          1 1.250e+01 1.250e+01 2.500e+02 -1.736e-01
a1111 a1115          1 1.250e+01 1.250e+01 2.500e+02 -1.736e-01
a2111 a2112          1 1.250e+01 1.250e+01 2.500e+02 -1.736e-01
a2111 a2115          1 1.250e+01 1.250e+01 2.500e+02 -1.736e-01
a2111 a1111          1 5.000e+00 5.000e+00 6.250e+02  1.
a3111 a3112          1 1.250e+01 1.250e+01 2.500e+02 -1.736e-01
a3111 a3115          1 1.250e+01 1.250e+01 2.500e+02 -1.736e-01
a3111 a2111          1 5.000e+00 5.000e+00 6.250e+02  1.
a4111 a4112          1 1.250e+01 1.250e+01 2.500e+02 -1.736e-01
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a4111 a4115                1 1.250e+01 1.250e+01 2.500e+02       -1.736e-01
a4111 a3111                1 5.000e+00 5.000e+00 6.250e+02        1.
a1112 *  37                1 1.250e+01 0.000e+00 2.500e+02
a1112 a1116                1 1.250e+01 1.250e+01 2.500e+02       -1.736e-01
a2112 *  38                1 1.250e+01 0.000e+00 2.500e+02
a2112 a2116                1 1.250e+01 1.250e+01 2.500e+02       -1.736e-01
a2112 a1112                1 5.000e+00 5.000e+00 6.250e+02        1.
a3112 *  39                1 1.250e+01 0.000e+00 2.500e+02
a3112 a3116                1 1.250e+01 1.250e+01 2.500e+02       -1.736e-01
a3112 a2112                1 5.000e+00 5.000e+00 6.250e+02        1.
a4112 *  40                1 1.250e+01 0.000e+00 2.500e+02
a4112 a4116                1 1.250e+01 1.250e+01 2.500e+02       -1.736e-01
a4112 a3112                1 5.000e+00 5.000e+00 6.250e+02        1.
a1113 *  41                1 1.250e+01 0.000e+00 2.500e+02
a1113 a1114                1 1.250e+01 1.250e+01 2.500e+02       -1.736e-01
a1113 *  42                1 1.250e+01 0.000e+00 2.500e+02
a2113 *  43                1 1.250e+01 0.000e+00 2.500e+02
a2113 a2114                1 1.250e+01 1.250e+01 2.500e+02       -1.736e-01
a2113 *  44                1 1.250e+01 0.000e+00 2.500e+02
a2113 a1113                1 5.000e+00 5.000e+00 6.250e+02        1.
a3113 *  45                1 1.250e+01 0.000e+00 2.500e+02
a3113 a3114                1 1.250e+01 1.250e+01 2.500e+02       -1.736e-01
a3113 *  46                1 1.250e+01 0.000e+00 2.500e+02
a3113 a2113                1 5.000e+00 5.000e+00 6.250e+02        1.
a4113 *  47                1 1.250e+01 0.000e+00 2.500e+02
a4113 a4114                1 1.250e+01 1.250e+01 2.500e+02       -1.736e-01
a4113 *  48                1 1.250e+01 0.000e+00 2.500e+02
a4113 a3113                1 5.000e+00 5.000e+00 6.250e+02        1.
a1114 a1115                1 1.250e+01 1.250e+01 2.500e+02       -1.736e-01
a1114 *  49                1 1.250e+01 0.000e+00 2.500e+02
a2114 a2115                1 1.250e+01 1.250e+01 2.500e+02       -1.736e-01
a2114 *  50                1 1.250e+01 0.000e+00 2.500e+02
a2114 a1114                1 5.000e+00 5.000e+00 6.250e+02        1.
a3114 a3115                1 1.250e+01 1.250e+01 2.500e+02       -1.736e-01
a3114 *  51                1 1.250e+01 0.000e+00 2.500e+02
a3114 a2114                1 5.000e+00 5.000e+00 6.250e+02        1.
a4114 a4115                1 1.250e+01 1.250e+01 2.500e+02       -1.736e-01
a4114 *  52                1 1.250e+01 0.000e+00 2.500e+02
a4114 a3114                1 5.000e+00 5.000e+00 6.250e+02        1.
a1115 a1116                1 1.250e+01 1.250e+01 2.500e+02       -1.736e-01
a1115 *  53                1 1.250e+01 0.000e+00 2.500e+02
a2115 a2116                1 1.250e+01 1.250e+01 2.500e+02       -1.736e-01
a2115 *  54                1 1.250e+01 0.000e+00 2.500e+02
a2115 a1115                1 5.000e+00 5.000e+00 6.250e+02        1.
a3115 a3116                1 1.250e+01 1.250e+01 2.500e+02       -1.736e-01
a3115 *  55                1 1.250e+01 0.000e+00 2.500e+02
a3115 a2115                1 5.000e+00 5.000e+00 6.250e+02        1.
a4115 a4116                1 1.250e+01 1.250e+01 2.500e+02       -1.736e-01
a4115 *  56                1 1.250e+01 0.000e+00 2.500e+02
a4115 a3115                1 5.000e+00 5.000e+00 6.250e+02        1.
a1116 *  57                1 1.250e+01 0.000e+00 2.500e+02
a1116 *  58                1 1.250e+01 0.000e+00 2.500e+02
a2116 *  59                1 1.250e+01 0.000e+00 2.500e+02
a2116 *  60                1 1.250e+01 0.000e+00 2.500e+02
a2116 a1116                1 5.000e+00 5.000e+00 6.250e+02        1.
a3116 *  61                1 1.250e+01 0.000e+00 2.500e+02
a3116 *  62                1 1.250e+01 0.000e+00 2.500e+02
a3116 a2116                1 5.000e+00 5.000e+00 6.250e+02        1.
a4116 *  63                1 1.250e+01 0.000e+00 2.500e+02
a4116 *  64                1 1.250e+01 0.000e+00 2.500e+02
a4116 a3116                1 5.000e+00 5.000e+00 6.250e+02        1.
```

filename: SEGMT

```
  0   0   0  25  0 a11 1   *  1
  0  25  25  25  1 a11 1 a11 2
 25  25  25   0  1 a11 1 a11 5
 25   0   0   0  0 a11 1   *  2
  0   0   0  25  0 a21 1   *  3
  0  25  25  25  1 a21 1 a21 2
 25  25  25   0  1 a21 1 a21 5
 25   0   0   0  0 a21 1   *  4
  0   0   0  25  0 a31 1   *  5
  0  25  25  25  1 a31 1 a31 2
 25  25  25   0  1 a31 1 a31 5
 25   0   0   0  0 a31 1   *  6
  0   0   0  25  0 a41 1   *  7
  0  25  25  25  1 a41 1 a41 2
 25  25  25   0  1 a41 1 a41 5
 25   0   0   0  0 a41 1   *  8
  0  25   0  50  0 a11 2   *  9
  0  50  25  50  1 a11 2 a11 3
 25  50  25  25  1 a11 2 a11 6
 25  25   0  25  0 a11 2 a11 1
  0  25   0  50  0 a21 2   * 10
  0  50  25  50  1 a21 2 a21 3
 25  50  25  25  1 a21 2 a21 6
 25  25   0  25  0 a21 2 a21 1
  0  25   0  50  0 a31 2   * 11
  0  50  25  50  1 a31 2 a31 3
 25  50  25  25  1 a31 2 a31 6
 25  25   0  25  0 a31 2 a31 1
  0  25   0  50  0 a41 2   * 12
  0  50  25  50  1 a41 2 a41 3
 25  50  25  25  1 a41 2 a41 6
 25  25   0  25  0 a41 2 a41 1
  0  50   0  75  0 a11 3   * 13
  0  75  25  75  1 a11 3 a11 4
 25  75  25  50  1 a11 3 a11 7
 25  50   0  50  0 a11 3 a11 2
  0  50   0  75  0 a21 3   * 14
  0  75  25  75  1 a21 3 a21 4
 25  75  25  50  1 a21 3 a21 7
 25  50   0  50  0 a21 3 a21 2
  0  50   0  75  0 a31 3   * 15
  0  75  25  75  1 a31 3 a31 4
 25  75  25  50  1 a31 3 a31 7
 25  50   0  50  0 a31 3 a31 2
  0  50   0  75  0 a41 3   * 16
  0  75  25  75  1 a41 3 a41 4
 25  75  25  50  1 a41 3 a41 7
 25  50   0  50  0 a41 3 a41 2
  0 100  25 100  0 a11 4   * 17
 25 100  25  75  1 a11 4 a11 8
 25  75   0  75  0 a11 4 a11 3
  0  75   0 100  0 a11 4   * 18
  0 100  25 100  0 a21 4   * 19
 25 100  25  75  1 a21 4 a21 8
 25  75   0  75  0 a21 4 a21 3
  0  75   0 100  0 a21 4   * 20
  0 100  25 100  0 a31 4   * 21
 25 100  25  75  1 a31 4 a31 8
 25  75   0  75  0 a31 4 a31 3
  0  75   0 100  0 a31 4   * 22
  0 100  25 100  0 a41 4   * 23
 25 100  25  75  1 a41 4 a41 8
 25  75   0  75  0 a41 4 a41 3
  0  75   0 100  0 a41 4   * 24
 25   0  25  25  0 a11 5 a11 1
 25  25  50  25  1 a11 5 a11 6
 50  25  50   0  1 a11 5 a11 9
 50   0  25   0  0 a11 5   * 25
 25   0  25  25  0 a21 5 a21 1
 25  25  50  25  1 a21 5 a21 6
 50  25  50   0  1 a21 5 a21 9
 50   0  25   0  0 a21 5   * 26
 25   0  25  25  0 a31 5 a31 1
 25  25  50  25  1 a31 5 a31 6
 50  25  50   0  1 a31 5 a31 9
```

50	0	25	0	0	a31 5	* 27
25	0	25	25	0	a41 5	a41 1
25	25	50	25	1	a41 5	a41 6
50	25	50	0	1	a41 5	a41 9
50	0	25	0	0	a41 5	* 28
25	25	25	50	0	a11 6	a11 2
25	50	50	50	1	a11 6	a11 7
50	50	50	25	1	a11 6	a1110
50	25	25	25	0	a11 6	a11 5
25	25	25	50	0	a21 6	a21 2
25	50	50	50	1	a21 6	a21 7
50	50	50	25	1	a21 6	a2110
50	25	25	25	0	a21 6	a21 5
25	25	25	50	0	a31 6	a31 2
25	50	50	50	1	a31 6	a31 7
50	50	50	25	1	a31 6	a3110
50	25	25	25	0	a31 6	a31 5
25	25	25	50	0	a41 6	a41 2
25	50	50	50	1	a41 6	a41 7
50	50	50	25	1	a41 6	a4110
50	25	25	25	0	a41 6	a41 5
25	50	25	75	0	a11 7	a11 3
25	75	50	75	1	a11 7	a11 8
50	75	50	50	1	a11 7	a1111
50	50	25	50	0	a11 7	a11 6
25	50	25	75	0	a21 7	a21 3
25	75	50	75	1	a21 7	a21 8
50	75	50	50	1	a21 7	a2111
50	50	25	50	0	a21 7	a21 6
25	50	25	75	0	a31 7	a31 3
25	75	50	75	1	a31 7	a31 8
50	75	50	50	1	a31 7	a3111
50	50	25	50	0	a31 7	a31 6
25	50	25	75	0	a41 7	a41 3
25	75	50	75	1	a41 7	a41 8
50	75	50	50	1	a41 7	a4111
50	50	25	50	0	a41 7	a41 6
25	75	25	100	0	a11 8	a11 4
25	100	50	100	0	a11 8	* 29
50	100	50	75	1	a11 8	a1112
50	75	25	75	0	a11 8	a11 7
25	75	25	100	0	a21 8	a21 4
25	100	50	100	0	a21 8	* 30
50	100	50	75	1	a21 8	a2112
50	75	25	75	0	a21 8	a21 7
25	75	25	100	0	a31 8	a31 4
25	100	50	100	0	a31 8	* 31
50	100	50	75	1	a31 8	a3112
50	75	25	75	0	a31 8	a31 7
25	75	25	100	0	a41 8	a41 4
25	100	50	100	0	a41 8	* 32
50	100	50	75	1	a41 8	a4112
50	75	25	75	0	a41 8	a41 7
50	0	50	25	0	a11 9	a11 5
50	25	75	25	1	a11 9	a1110
75	25	75	0	1	a11 9	a1113
75	0	50	0	0	a11 9	* 33
50	0	50	25	0	a21 9	a21 5
50	25	75	25	1	a21 9	a2110
75	25	75	0	1	a21 9	a2113
75	0	50	0	0	a21 9	* 34
50	0	50	25	0	a31 9	a31 5
50	25	75	25	1	a31 9	a3110
75	25	75	0	1	a31 9	a3113
75	0	50	0	0	a31 9	* 35
50	0	50	25	0	a41 9	a41 5
50	25	75	25	1	a41 9	a4110
75	25	75	0	1	a41 9	a4113
75	0	50	0	0	a41 9	* 36
50	25	50	50	0	a1110	a11 6
50	50	75	50	1	a1110	a1111
75	50	75	25	1	a1110	a1114
75	25	50	25	0	a1110	a11 9

50	25	50	50	0	a2110	a21 6
50	50	75	50	1	a2110	a2111
75	50	75	25	1	a2110	a2114
75	25	50	25	0	a2110	a21 9
50	25	50	50	0	a3110	a31 6
50	50	75	50	1	a3110	a3111
75	50	75	25	1	a3110	a3114
75	25	50	25	0	a3110	a31 9
50	25	50	50	0	a4110	a41 6
50	50	75	50	1	a4110	a4111
75	50	75	25	1	a4110	a4114
75	25	50	25	0	a4110	a41 9
50	50	50	75	0	a1111	a11 7
50	75	75	75	1	a1111	a1112
75	75	75	50	1	a1111	a1115
75	50	50	50	0	a1111	a1110
50	50	50	75	0	a2111	a21 7
50	75	75	75	1	a2111	a2112
75	75	75	50	1	a2111	a2115
75	50	50	50	0	a2111	a2110
50	50	50	75	0	a3111	a31 7
50	75	75	75	1	a3111	a3112
75	75	75	50	1	a3111	a3115
75	50	50	50	0	a3111	a3110
50	50	50	75	0	a4111	a41 7
50	75	75	75	1	a4111	a4112
75	75	75	50	1	a4111	a4115
75	50	50	50	0	a4111	a4110
75	75	50	75	0	a1112	a1111
50	75	50	100	0	a1112	a11 8
50	100	75	100	0	a1112	* 37
75	100	75	75	1	a1112	a1116
75	75	50	75	0	a2112	a2111
50	75	50	100	0	a2112	a21 8
50	100	75	100	0	a2112	* 38
75	100	75	75	1	a2112	a2116
75	75	50	75	0	a3112	a3111
50	75	50	100	0	a3112	a31 8
50	100	75	100	0	a3112	* 39
75	100	75	75	1	a3112	a3116
75	75	50	75	0	a4112	a4111
50	75	50	100	0	a4112	a41 8
50	100	75	100	0	a4112	* 40
75	100	75	75	1	a4112	a4116
100	0	75	0	0	a1113	* 41
75	0	75	25	0	a1113	a11 9
75	25	100	25	1	a1113	a1114
100	25	100	0	0	a1113	* 42
100	0	75	0	0	a2113	* 43
75	0	75	25	0	a2113	a21 9
75	25	100	25	1	a2113	a2114
100	25	100	0	0	a2113	* 44
100	0	75	0	0	a3113	* 45
75	0	75	25	0	a3113	a31 9
75	25	100	25	1	a3113	a3114
100	25	100	0	0	a3113	* 46
100	0	75	0	0	a4113	* 47
75	0	75	25	0	a4113	a41 9
75	25	100	25	1	a4113	a4114
100	25	100	0	0	a4113	* 48
75	25	75	50	0	a1114	a1110
75	50	100	50	1	a1114	a1115
100	50	100	25	0	a1114	* 49
100	25	75	25	0	a1114	a1113
75	25	75	50	0	a2114	a2110
75	50	100	50	1	a2114	a2115
100	50	100	25	0	a2114	* 50
100	25	75	25	0	a2114	a2113
75	25	75	50	0	a3114	a3110
75	50	100	50	1	a3114	a3115
100	50	100	25	0	a3114	* 51
100	25	75	25	0	a3114	a3113
75	25	75	50	0	a4114	a4110

75	50	100	50	1	a4114	a4115
100	50	100	25	0	a4114	* 52
100	25	75	25	0	a4114	a4113
100	50	75	50	0	a1115	a1114
75	50	75	75	0	a1115	a1111
75	75	100	75	1	a1115	a1116
100	75	100	50	0	a1115	* 53
100	50	75	50	0	a2115	a2114
75	50	75	75	0	a2115	a2111
75	75	100	75	1	a2115	a2116
100	75	100	50	0	a2115	* 54
100	50	75	50	0	a3115	a3114
75	50	75	75	0	a3115	a3111
75	75	100	75	1	a3115	a3116
100	75	100	50	0	a3115	* 55
100	50	75	50	0	a4115	a4114
75	50	75	75	0	a4115	a4111
75	75	100	75	1	a4115	a4116
100	75	100	50	0	a4115	* 56
100	100	100	75	0	a1116	* 57
100	75	75	75	0	a1116	a1115
75	75	75	100	0	a1116	a1112
75	100	100	100	0	a1116	* 58
100	100	100	75	0	a2116	* 59
100	75	75	75	0	a2116	a2115
75	75	75	100	0	a2116	a2112
75	100	100	100	0	a2116	* 60
100	100	100	75	0	a3116	* 61
100	75	75	75	0	a3116	a3115
75	75	75	100	0	a3116	a3112
75	100	100	100	0	a3116	* 62
100	100	100	75	0	a4116	* 63
100	75	75	75	0	a4116	a4115
75	75	75	100	0	a4116	a4112
75	100	100	100	0	a4116	* 64

Example 3.3.6 Non-uniform 2D grid spacing in a rhombohedron domain
Test Case and Expected Output as Provided in the AMESH User's Manual

filename: IN

```
locat
a11 1  101     10.5000000000  19.9502999793  50.00000       10.0000
a11 2  101     14.5000000000  41.1505999586  50.00000       10.0000
a11 3  101     11.5000000000  67.1505999586  50.00000       10.0000
a11 4  101     8.5000000000   95.9502999793  50.00000       10.0000
a11 5  101     39.9622305477  33.4502999793  50.00000       10.0000
a11 6  101     35.9622305477  53.6505999586  50.00000       10.0000
a11 7  101     37.9622305477  81.6505999586  50.00000       10.0000
a11 8  101     33.9622305477  103.4502999793 50.00000       10.0000
a11 9  101     66.9622305477  46.9502999793  50.00000       10.0000
a1110  101     63.9622305477  72.1505999586  50.00000       10.0000
a1111  101     68.9622305477  90.1505999586  50.00000       10.0000
a1112  101     62.9622305477  120.9502999793 50.00000       10.0000
a1113  101     87.7311152738  51.4502999793  50.00000       10.0000
a1114  101     95.7311152738  96.6505999586  50.00000       10.0000
a1115  101     87.7311152738  111.6505999586 50.00000       10.0000
a1116  101     92.7311152738  133.4502999793 50.00000       10.0000

bound
0.0    0.0
0.0    100.0
100.0  150.0
100.0  50.0

toler
0.5
```

filename: ELEME

```
eleme
a11 1  rock1   6.476e+03      10.500  19.950  50.0000
a11 2  rock1   6.036e+03      14.500  41.151  50.0000
a11 3  rock1   6.731e+03      11.500  67.151  50.0000
a11 4  rock1   5.074e+03      8.500   95.950  50.0000
a11 5  rock1   6.560e+03      39.962  33.450  50.0000
a11 6  rock1   6.387e+03      35.962  53.651  50.0000
a11 7  rock1   6.999e+03      37.962  81.651  50.0000
a11 8  rock1   7.071e+03      33.962  103.450 50.0000
a11 9  rock1   6.291e+03      66.962  46.950  50.0000
a1110  rock1   6.746e+03      63.962  72.151  50.0000
a1111  rock1   7.212e+03      68.962  90.151  50.0000
a1112  rock1   7.189e+03      62.962  120.950 50.0000
a1113  rock1   6.279e+03      87.731  51.450  50.0000
a1114  rock1   4.881e+03      95.731  96.651  50.0000
a1115  rock1   5.050e+03      87.731  111.651 50.0000
a1116  rock1   5.018e+03      92.731  133.450 50.0000
```

filename: CONNE

```
conne
a11 1  a11 2  1      1.079e+01      1.079e+01      2.494e+02      0.0
a11 1  a11 5  1      1.620e+01      1.620e+01      1.435e+02      0.0
a11 2  a11 3  1      1.309e+01      1.309e+01      2.092e+02      0.0
a11 2  a11 6  1      1.242e+01      1.242e+01      1.546e+02      0.0
a11 2  a11 5  1      1.330e+01      1.330e+01      1.400e+02      0.0
a11 3  a11 4  1      1.448e+01      1.448e+01      2.034e+02      0.0
a11 3  a11 7  1      1.509e+01      1.509e+01      1.634e+02      0.0
a11 3  a11 6  1      1.397e+01      1.397e+01      1.512e+02      0.0
a11 4  a11 8  1      1.327e+01      1.327e+01      1.966e+02      0.0
a11 4  a11 7  1      1.637e+01      1.637e+01      8.600e+01      0.0
a11 5  a11 6  1      1.030e+01      1.030e+01      2.241e+02      0.0
a11 5  a11 9  1      1.509e+01      1.509e+01      1.858e+02      0.0
a11 6  a11 7  1      1.404e+01      1.404e+01      1.928e+02      0.0
a11 6  a1110  1      1.678e+01      1.678e+01      1.058e+02      0.0
a11 6  a11 9  1      1.586e+01      1.586e+01      1.232e+02      0.0
a11 7  a11 8  1      1.108e+01      1.108e+01      2.735e+02      0.0
a11 7  a1111  1      1.607e+01      1.607e+01      1.101e+02      0.0
```

```
a11 7  a1110   1       1.384e+01       1.384e+01       1.890e+02       0.0
a11 8  a1112   1       1.694e+01       1.694e+01       2.131e+02       0.0
a11 8  a1111   1       1.872e+01       1.872e+01       8.462e+01       0.0
a11 9  a1110   1       1.269e+01       1.269e+01       2.187e+02       0.0
a11 9  a1113   1       1.063e+01       1.063e+01       2.145e+02       0.0
a1110  a1111   1       9.341e+00       9.341e+00       3.413e+02       0.0
a1110  a1114   1       2.006e+01       2.006e+01       8.622e+00       0.0
a1110  a1113   1       1.576e+01       1.576e+01       1.880e+02       0.0
a1111  a1112   1       1.569e+01       1.569e+01       1.817e+02       0.0
a1111  a1115   1       1.427e+01       1.427e+01       1.245e+02       0.0
a1111  a1114   1       1.377e+01       1.377e+01       2.362e+02       0.0
a1112  a1116   1       1.614e+01       1.614e+01       1.268e+02       0.0
a1112  a1115   1       1.323e+01       1.323e+01       1.979e+02       0.0
a1113  a1114   1       2.295e+01       2.295e+01       1.299e+02       0.0
a1114  a1115   1       8.500e+00       8.500e+00       2.141e+02       0.0
a1115  a1116   1       1.118e+01       1.118e+01       2.187e+02       0.0
```

filename: SEGMT

```
0               0               0               32.9089072      0       a11 1   *   1
0               32.9089072      24.5047879      28.2854277      1       a11 1   a11 2
24.5047879      28.2854277      30.4819385      15.2409693      1       a11 1   a11 5
30.4819385      15.2409693      0               0               0       a11 1   *   2
0               32.9089072      0               52.6506         0       a11 2   *   3
0               52.6506         20.7771494      55.0479634      1       a11 2   a11 3
20.7771494      55.0479634      28.5580819      41.68827        1       a11 2   a11 6
28.5580819      41.68827        24.5047879      28.2854277      1       a11 2   a11 5
24.5047879      28.2854277      0               32.9089072      0       a11 2   a11 1
0               52.6506         0               80.5087725      0       a11 3   *   4
0               80.5087725      20.2294638      82.6160302      1       a11 3   a11 4
20.2294638      82.6160302      28.0822255      68.284886       1       a11 3   a11 7
28.0822255      68.284886       20.7771494      55.0479634      1       a11 3   a11 6
20.7771494      55.0479634      0               52.6506         0       a11 3   a11 2
0               100             18.4287126      109.214356      0       a11 4   *   5
18.4287126      109.214356      23.9844963      90.3526703      1       a11 4   a11 8
....
58.8499044      29.4249522      30.4819385      15.2409693      0       a11 5   *   7
20.7771494      55.0479634      28.0822255      68.284886       0       a11 6   a11 3
28.0822255      68.284886       47.3122975      66.9113095      1       a11 6   a11 7
47.3122975      66.9113095      53.1445742      58.0840798      1       a11 6   a1110
53.1445742      58.0840798      50.5416836      46.0413938      1       a11 6   a11 9
50.5416836      46.0413938      28.5580819      41.68827        0       a11 6   a11 5
28.5580819      41.68827        20.7771494      55.0479634      0       a11 6   a11 2
....
100             72.5869403      100             50              0       a1113   *  12
86.6852466      75.5330955      81.1116279      98.4868734      0       a1114   a1111
81.1116279      98.4868734      100             108.560672      1       a1114   a1115
100             108.560672      100             72.5869403      0       a1114   *  13
100             72.5869403      87.2117964      74.8503241      0       a1114   a1113
87.2117964      74.8503241      86.6852466      75.5330955      0       a1114   a1110
100             108.560672      81.1116279      98.4868734      0       a1115   a1114
81.1116279      98.4868734      71.7325414      106.674547      0       a1115   a1111
71.7325414      106.674547      78.6873869      125.198131      0       a1115   a1112
78.6873869      125.198131      100             120.309849      1       a1115   a1116
100             120.309849      100             108.560672      0       a1115   *  14
100             150             100             120.309849      0       a1116   *  15
100             120.309849      78.6873869      125.198131      0       a1116   a1115
78.6873869      125.198131      73.7783083      136.889154      0       a1116   a1112
73.7783083      136.889154      100             150             0       a1116   *  16
```

Example 3.3.6 Non-uniform 2D grid spacing in a rhombohedron domain
Acceptance Test: Results Generated by AMESH

filename: IN

```
locat
a11 1  101     10.5000000000   19.9502999793 50.00000       10.0000
a11 2  101     14.5000000000   41.1505999586 50.00000       10.0000
a11 3  101     11.5000000000   67.1505999586 50.00000       10.0000
a11 4  101      8.5000000000   95.9502999793 50.00000       10.0000
a11 5  101     39.9622305477   33.4502999793 50.00000       10.0000
a11 6  101     35.9622305477   53.6505999586 50.00000       10.0000
a11 7  101     37.9622305477   81.6505999586 50.00000       10.0000
a11 8  101     33.9622305477  103.4502999793 50.00000       10.0000
a11 9  101     66.9622305477   46.9502999793 50.00000       10.0000
a1110  101     63.9622305477   72.1505999586 50.00000       10.0000
a1111  101     68.9622305477   90.1505999586 50.00000       10.0000
a1112  101     62.9622305477  120.9502999793 50.00000       10.0000
a1113  101     87.7311152738   51.4502999793 50.00000       10.0000
a1114  101     95.7311152738   96.6505999586 50.00000       10.0000
a1115  101     87.7311152738  111.6505999586 50.00000       10.0000
a1116  101     92.7311152738  133.4502999793 50.00000       10.0000

bound
0.0   0.0
0.0   100.0
100.0 150.0
100.0 50.0

toler
0.5
```

filename: ELEME

```
eleme
a11 1          rock1 6.476e+03                10.500      19.950      50.0000
a11 2          rock1 6.036e+03                14.500      41.151      50.0000
a11 3          rock1 6.731e+03                11.500      67.151      50.0000
a11 4          rock1 5.074e+03                 8.500      95.950      50.0000
a11 5          rock1 6.560e+03                39.962      33.450      50.0000
a11 6          rock1 6.387e+03                35.962      53.651      50.0000
a11 7          rock1 6.999e+03                37.962      81.651      50.0000
a11 8          rock1 7.071e+03                33.962     103.450      50.0000
a11 9          rock1 6.291e+03                66.962      46.950      50.0000
a1110          rock1 6.746e+03                63.962      72.151      50.0000
a1111          rock1 7.212e+03                68.962      90.151      50.0000
a1112          rock1 7.189e+03                62.962     120.950      50.0000
a1113          rock1 6.279e+03                87.731      51.450      50.0000
a1114          rock1 4.881e+03                95.731      96.651      50.0000
a1115          rock1 5.050e+03                87.731     111.651      50.0000
a1116          rock1 5.018e+03                92.731     133.450      50.0000
```

filename: CONNE

```
conne
a11 1 *   1                    1 1.050e+01 0.000e+00 3.291e+02
a11 1 a11 2                    1 1.079e+01 1.079e+01 2.494e+02
a11 1 a11 5                    1 1.620e+01 1.620e+01 1.435e+02
a11 1 *   2                    1 1.315e+01 0.000e+00 3.408e+02
a11 2 *   3                    1 1.450e+01 0.000e+00 1.974e+02
a11 2 a11 3                    1 1.309e+01 1.309e+01 2.092e+02
a11 2 a11 6                    1 1.242e+01 1.242e+01 1.546e+02
a11 2 a11 5                    1 1.330e+01 1.330e+01 1.400e+02
a11 3 *   4                    1 1.150e+01 0.000e+00 2.786e+02
a11 3 a11 4                    1 1.448e+01 1.448e+01 2.034e+02
a11 3 a11 7                    1 1.509e+01 1.509e+01 1.634e+02
a11 3 a11 6                    1 1.397e+01 1.397e+01 1.512e+02
a11 4 *   5                    1 7.423e+00 0.000e+00 2.060e+02
a11 4 a11 8                    1 1.327e+01 1.327e+01 1.966e+02
a11 4 a11 7                    1 1.637e+01 1.637e+01 8.600e+01
a11 4 *   6                    1 8.500e+00 0.000e+00 1.949e+02
a11 5 a11 6                    1 1.030e+01 1.030e+01 2.241e+02
a11 5 a11 9                    1 1.509e+01 1.509e+01 1.858e+02
a11 5 *   7                    1 1.205e+01 0.000e+00 3.172e+02
a11 6 a11 7                    1 1.404e+01 1.404e+01 1.928e+02
a11 6 a1110                    1 1.678e+01 1.678e+01 1.058e+02
a11 6 a11 9                    1 1.586e+01 1.586e+01 1.232e+02
a11 7 a11 8                    1 1.108e+01 1.108e+01 2.735e+02
a11 7 a1111                    1 1.607e+01 1.607e+01 1.101e+02
a11 7 a1110                    1 1.384e+01 1.384e+01 1.890e+02
a11 8 *   8                    1 1.210e+01 0.000e+00 2.734e+02
a11 8 a1112                    1 1.694e+01 1.694e+01 2.131e+02
a11 8 a1111                    1 1.872e+01 1.872e+01 8.462e+01
a11 9 a1110                    1 1.269e+01 1.269e+01 2.187e+02
a11 9 a1113                    1 1.063e+01 1.063e+01 2.145e+02
a11 9 *   9                    1 1.205e+01 0.000e+00 2.298e+02
a1110 a1111                    1 9.341e+00 9.341e+00 3.413e+02
a1110 a1114                    1 2.006e+01 2.006e+01 8.622e+00
a1110 a1113                    1 1.576e+01 1.576e+01 1.880e+02
a1111 a1112                    1 1.569e+01 1.569e+01 1.817e+02
a1111 a1115                    1 1.427e+01 1.427e+01 1.245e+02
a1111 a1114                    1 1.377e+01 1.377e+01 2.362e+02
a1112 *  10                    1 9.419e+00 0.000e+00 3.454e+02
a1112 a1116                    1 1.614e+01 1.614e+01 1.268e+02
a1112 a1115                    1 1.323e+01 1.323e+01 1.979e+02
a1113 *  11                    1 6.784e+00 0.000e+00 2.303e+02
a1113 a1114                    1 2.295e+01 2.295e+01 1.299e+02
a1113 *  12                    1 1.227e+01 0.000e+00 2.259e+02
a1114 a1115                    1 8.500e+00 8.500e+00 2.141e+02
a1114 *  13                    1 4.269e+00 0.000e+00 3.597e+02
a1115 a1116                    1 1.118e+01 1.118e+01 2.187e+02
a1115 *  14                    1 1.227e+01 0.000e+00 1.175e+02
a1116 *  15                    1 7.269e+00 0.000e+00 2.969e+02
a1116 *  16                    1 1.155e+01 0.000e+00 2.932e+02
```

filename: SEGMT

0	0	0	32.9089072	0	a11 1	* 1
0	32.9089072	24.5047879	28.2854277	1	a11 1	a11 2
24.5047879	28.2854277	30.4819385	15.2409693	1	a11 1	a11 5
30.4819385	15.2409693	0	0	0	a11 1	* 2
0	32.9089072	0	52.6506	0	a11 2	* 3
0	52.6506	20.7771494	55.0479634	1	a11 2	a11 3
20.7771494	55.0479634	28.5580819	41.68827	1	a11 2	a11 6
28.5580819	41.68827	24.5047879	28.2854277	1	a11 2	a11 5
24.5047879	28.2854277	0	32.9089072	0	a11 2	a11 1
0	52.6506	0	80.5087725	0	a11 3	* 4
0	80.5087725	20.2294638	82.6160302	1	a11 3	a11 4
20.2294638	82.6160302	28.0822255	68.284886	1	a11 3	a11 7
28.0822255	68.284886	20.7771494	55.0479634	1	a11 3	a11 6
20.7771494	55.0479634	0	52.6506	0	a11 3	a11 2
0	100	18.4287126	109.214356	0	a11 4	* 5
18.4287126	109.214356	23.9844963	90.3526703	1	a11 4	a11 8
23.9844963	90.3526703	20.2294638	82.6160302	1	a11 4	a11 7
20.2294638	82.6160302	0	80.5087725	0	a11 4	a11 3
0	80.5087725	0	100	0	a11 4	* 6
30.4819385	15.2409693	24.5047879	28.2854277	0	a11 5	a11 1
24.5047879	28.2854277	28.5580819	41.68827	0	a11 5	a11 2
28.5580819	41.68827	50.5416836	46.0413938	1	a11 5	a11 6
50.5416836	46.0413938	58.8499044	29.4249522	1	a11 5	a11 9
58.8499044	29.4249522	30.4819385	15.2409693	0	a11 5	* 7
20.7771494	55.0479634	28.0822255	68.284886	0	a11 6	a11 3
28.0822255	68.284886	47.3122975	66.9113095	1	a11 6	a11 7
47.3122975	66.9113095	53.1445742	58.0840798	1	a11 6	a1110
53.1445742	58.0840798	50.5416836	46.0413938	1	a11 6	a11 9
50.5416836	46.0413938	28.5580819	41.68827	0	a11 6	a11 5
28.5580819	41.68827	20.7771494	55.0479634	0	a11 6	a11 2
28.0822255	68.284886	20.2294638	82.6160302	0	a11 7	a11 3
20.2294638	82.6160302	23.9844963	90.3526703	0	a11 7	a11 4
23.9844963	90.3526703	50.8879502	95.2891518	1	a11 7	a11 8
50.8879502	95.2891518	53.8002519	84.6678163	1	a11 7	a1111
53.8002519	84.6678163	47.3122975	66.9113095	1	a11 7	a1110
47.3122975	66.9113095	28.0822255	68.284886	0	a11 7	a11 6
23.9844963	90.3526703	18.4287126	109.214356	0	a11 8	a11 4
18.4287126	109.214356	42.8850314	121.442516	0	a11 8	* 8
42.8850314	121.442516	53.8937889	103.199432	1	a11 8	a1112
53.8937889	103.199432	50.8879502	95.2891518	1	a11 8	a1111
50.8879502	95.2891518	23.9844963	90.3526703	0	a11 8	a11 7
58.8499044	29.4249522	50.5416836	46.0413938	0	a11 9	a11 5
50.5416836	46.0413938	53.1445742	58.0840798	0	a11 9	a11 6
53.1445742	58.0840798	74.8616564	60.6694159	1	a11 9	a1110
74.8616564	60.6694159	79.4046065	39.7023032	1	a11 9	a1113
79.4046065	39.7023032	58.8499044	29.4249522	0	a11 9	* 9
47.3122975	66.9113095	53.8002519	84.6678163	0	a1110	a11 7
53.8002519	84.6678163	86.6852466	75.5330955	1	a1110	a1111
86.6852466	75.5330955	87.2117964	74.8503241	1	a1110	a1114
87.2117964	74.8503241	74.8616564	60.6694159	1	a1110	a1113
74.8616564	60.6694159	53.1445742	58.0840798	0	a1110	a11 9
53.1445742	58.0840798	47.3122975	66.9113095	0	a1110	a11 6
50.8879502	95.2891518	53.8937889	103.199432	0	a1111	a11 8
53.8937889	103.199432	71.7325414	106.674547	1	a1111	a1112
71.7325414	106.674547	81.1116279	98.4868734	1	a1111	a1115
81.1116279	98.4868734	86.6852466	75.5330955	1	a1111	a1114
86.6852466	75.5330955	53.8002519	84.6678163	0	a1111	a1110
53.8002519	84.6678163	50.8879502	95.2891518	0	a1111	a11 7
53.8937889	103.199432	42.8850314	121.442516	0	a1112	a11 8
42.8850314	121.442516	73.7783083	136.889154	0	a1112	* 10
73.7783083	136.889154	78.6873869	125.198131	1	a1112	a1116
78.6873869	125.198131	71.7325414	106.674547	1	a1112	a1115
71.7325414	106.674547	53.8937889	103.199432	0	a1112	a1111
100	50	79.4046065	39.7023032	0	a1113	* 11
79.4046065	39.7023032	74.8616564	60.6694159	0	a1113	a11 9
74.8616564	60.6694159	87.2117964	74.8503241	0	a1113	a1110
87.2117964	74.8503241	100	72.5869403	1	a1113	a1114
100	72.5869403	100	50	0	a1113	* 12
86.6852466	75.5330955	81.1116279	98.4868734	0	a1114	a1111
81.1116279	98.4868734	100	108.560672	1	a1114	a1115
100	108.560672	100	72.5869403	0	a1114	* 13
100	72.5869403	87.2117964	74.8503241	0	a1114	a1113
87.2117964	74.8503241	86.6852466	75.5330955	0	a1114	a1110
100	108.560672	81.1116279	98.4868734	0	a1115	a1114
81.1116279	98.4868734	71.7325414	106.674547	0	a1115	a1111

71.7325414	106.674547	78.6873869	125.198131	0	a1115	a1112
78.6873869	125.198131	100	120.309849	1	a1115	a1116
100	120.309849	100	108.560672	0	a1115	* 14
100	150	100	120.309849	0	a1116	* 15
100	120.309849	78.6873869	125.198131	0	a1116	a1115
78.6873869	125.198131	73.7783083	136.889154	0	a1116	a1112
73.7783083	136.889154	100	150	0	a1116	* 16