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FAVOR Code Update

NRC-Industry Materials Information Exchange Public Meeting

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From last year's update

Findings from V&V assessment of FAVOR (TLR-RES/DE/CIB-2020-02, ML20017A170)

1 Absence of SQA Plan
- Draft SQA Plan created, under RES review and revisions

2 Absence of Change Control and Documentation
- Action to close: implement change control procedures in SQA plan
- GitHub repository created and FAVOR source put under version control in NRC's cloud environment (non-public)

3 Absence of Software Configuration Management
- Plans to create and implement Configuration Management And Maintenance Plan (CMMP)

4 Absence of FAVOR Baseline
- Plans to create and run test suite, document results as baseline

5 Key Capability Deficiency: As-Found Flaw Modeling
- 'As-found flaw' FAVOR code nearly completed and V&V testing mostly completed, documentation still underway

FAVOR Version 20.1.12

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Added capability to analyze as-found flaws; backwards compatible with version 16.1

- User's guide (ML21175A301)
  - Added Appendix C
- Theory manual (ML21175A300)
  - Added Section 2.1
  - Added Appendix H
- How to get the code (from the NRC public website):

https://www.nrc.gov/about-nrc/regulatory/research/obtainingcodes.html

Distribution of FAVOR is handled by the NRC staff. Requestors will need to fill out, sign, and return this non-disclosure agreement. When complete, it may be mailed to the address listed on the form or sent to safetycodes@nrc.gov. The code is provided at no cost; however, no technical assistance is provided.

As-found FAVOR v20.1.12 file

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Table C. 1: As-Found Flaw Input File

Flaw Unique ID Number – (Up to 5 characters)	Flaw Type[1] 1=ISB and 2=Embedded	Subregion In which flaw resides	Orientation[2] 1=Axial 2=Circum.	Depth[3] (inches)	Aspect[3] Ratio	Radial[4] Location (inches)
ABC12	1	13	1	2.1875	6	0
ABD45	2	10	2	0.8750	8.122	2.32
:	:	:	:	:	:	:
:	:	:	:	:	:	:
N	2	8	1	0.0875	3.108	1.038

- Prompted by IPFLAW parameter set equal to 4
  (uses only a single flaw file instead of three)
- Details are in Appendix C of the user's guide and Appendix H of the theory manual

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Summary of verification and validation for “as-found flaw” capability

- As-found flaw data are correctly read in
- Input data accurately processed to calculate other variables (axial/hoop stresses, RT_{NDT}, temperature at crack tip, etc.)
- Input data are within acceptable ranges
- Details in H.5 and H.6 in Appendix H of theory manual

FAVOR software quality assurance

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- Software quality assurance plan (ML21180A161)
- Configuration management and maintenance plan (ML21180A167)
- Software requirements document is underway.
- Continuous integration testing implemented: every time a change is made, tests are automatically performed, and test documentation is automatically generated.

FAVOR development still going

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Further enhancements to FAVOR are underway such as input generator, modularization, explicit typing, conversion to free-form source, continuous integration testing.

Regulatory applications of FAVOR:

- Used in the probabilistic fracture mechanics NRC acceptance of 10 CFR 50.55a(z)(1) alternative requests for BWR reactor pressure vessel circumferential welds
- Used in the technical basis for alternative pressurized thermal shock rule (10 CFR 50.61a)