3DStress User's Guide for Version 1.3

Abstract—3DStress is a tool for computing the propensity for a fault to slip or dilate based on three-dimensional (3D) stress conditions. The software is used by scientists and engineers to study the relationship between natural stress fields and geologic faulting and fracturing. 3DStress utilizes user defined stress fields to compute the likelihood of fault displacement based on fault orientation. 3DStress provides user input, computation, and data visualization tools to create an interactive environment in which various stress models may be studied and explored efficiently.

Slip tendency is a ratio of the shear stress (τ_s) divided by the normal stress (σ_n) on a fault surface, as shown in the equation below:

$$\text{Slip tendency} = \tau_s / \sigma_n$$

The principal stress with the greatest magnitude is called σ_1. The principal stress with the smallest magnitude is called σ_3. The intermediate principal stress is called σ_2.

Dilation tendency is the relative propensity for a fault or fracture to dilate based on the 3DStress conditions and is computed as shown in the equation below:

$$\text{Dilation tendency} = (\sigma_1 - \sigma_n) / (\sigma_1 - \sigma_3)$$

Leakage factor is a quantitative estimate of the propensity for a fault or fracture to dilate, for situations where fluid pressure and fault or fracture tensile strength are known or can be inferred. Leakage factor is computed as a function of pore fluid pressure (P_f), σ_n, and tensile strength (T) by the equation below:

$$\text{Leakage factor} = P_f / (\sigma_n - T)$$

3DStress executes on a silicon graphic workstation running the IRIX Operating System.