

## Crystal Lattice Orientation Evolution FEM

### Project Proposal:

The crystal lattice of metal grain is evolved through the use of different state variables such as strain, the slip system shearing rate, and the current crystal orientation. The crystal lattice orientation is evolved through time using a Crank-Nicholson method. During each time step, a finite element stiffness matrix is calculated to ensure that the entire lattice of the body is smooth at each time step. Currently, a serial version of this code is written in Fortran 90 with interfaces into the PETSC Library for the linear solver and Python as a post/pre processing interface. The goal of this project will be to parallelize the Fortran code such that it is able to evolve multiple grains at a time on what would be essentially independent nodes for each grain. Also, the solver needs to be modified such that it is able to solve the linear system for each grain independently of what the other nodes are doing. A familiarity of Fortran 90 and numerical linear or direct solvers would be strongly recommended for those interested in the project.