

## Project Topics for ME 531

**Projects Class Presentation, May 2, 2018 (10 mins., 8 slides max)**

**Project Report Due May 4 , 2018**

**Project reports should be less than 8 pages and typed including figures. You should have at least 10 references. A pdf copy via e-mail would be fine.**

- (1) A thorough literature review of strain rate effects on mechanical response (consider very high strain rates as well). Show an example of strain rate demo via **WARP3D**.
- (2) Consider the MTS model- Investigate its utilization for different materials. Find representation of 5 different materials with MTS and explain the behaviors.
- (3) Compare the latent hardening matrix from Bassani versus Pierce+Asaro+Needleman with a simple example.
- (4) Use the Ti cp model in WARP3d? Illustrate with a simple example.
- (5) Use the Hydrogen Model in **WARP3D**? Illustrate with an example on a single element.
- (6) A survey of pressure effects on materials- recent papers (include very high pressures) for bcc metals. Discuss non-Schmid behavior. How does yield strength change with pressure and how does elastic moduli change with pressure?
- (7) Cyclic hardening or softening and how is it incorporated into the constitutive equations (survey).
- (8) Modeling the stress- plastic strain behavior of a bimaterial interface (two grains of different orientations). You may use **WARP3D** to illustrate.
- (9) Solution of problems where the elastic modulus is a function of strain (literature survey, second order terms in elasticity, few examples)?
- (10) Using **LAMMPS**, the copper Mishin potential and the input.in file and using the run\_parallel.txt, determine the change in potential energy of the system as a function of increasing crack length. Move the cylindrical void to the surface and change its dimensions to make a crack.
- (11) Consider the CT and SEB geometries from **WARP3D**. Determine the crack tip stress-strain fields under  $\epsilon_y$  and  $\epsilon_{xy}$  allowing crack tip plasticity.
- (12) Using the Cantilever Example in WARP3D, please deform the cantilever under increasing loads and observe the growth of the plastic zone.
- (13) Explain the Kroner's idea of lattice incompatibility and other relevant papers?
- (14) Review of deformation (ratcheting) models relevant to contact loading (the importance of constitutive models)

(15) Using **LAMMPS**, the Cu Mishin potential, determine the elastic constants for the cubic crystal and compare the values with the literature. How well does this potential capture the  $C_{11}$ ,  $C_{12}$  and  $C_{44}$ .

(17) A project of your choice after consultation with me.