ICME Metals 4990/6990

Integrated Computational Materials Engineering for Metals

Cross listed ME, CE, ABE, ASE

**CATALOG DATA:** ICME/MECE/ABE/ASE 4990/6990. Integrated Computational Materials Engineering (3) (Prerequisite: EM 3213 Strength of Materials, ME3403 Materials: Three hours lecture. Survey course of various length scale computational analysis related to materials modeling: macroscale continuum theory, Crystal Plasticity, Dislocation Dynamics, Atomistic Methods, and Density Functional Theory. Emphasis upon projects and exercises.

**PREREQUISITE BY TOPIC:**

1. Basic knowledge of statics
2. Basic knowledge of dynamics
3. Basic knowledge of strength of materials
4. Basic knowledge of materials science

**TEXTBOOK:** Integrated Computational Materials Engineering for Metals: Using Multiscale Modeling to Invigorate Engineering Design with Science, M.F. Horstemeyer, Wiley, 2011.

**Coordinator:** M.F. Horstemeyer, Professor of Mechanical Engineering

**Objectives:** (Numbers in brackets show the relationship with ABET objectives)

1. To develop the student’s ability to solve different length scale computational analyses and bridge length scales. [1, 2, 5]

2. To develop the student’s ability to integrate materials information with mechanics. [1, 2, 3, 5]

3. To develop the student’s ability to join theory and experiments [1, 2, 3, 5]

**Topics Covered:** (Number of MWF classes)

1. Introduction (6)

2. Macroscale Models (13)

3. Mesoscale Models (5)

4. Dislocation Dynamics (5)

5. Atomistic Methods (6)

6. Electronics Structures Methods (4)

7. Case Studies (3)

8. Project Presentations (2)

**Assessments:** 1. Homeworks/exercises

1. Project reports
2. Quizzes

Prepared by: Mark F. Horstemeyer, CAVS Chair Professor in Mechanical Engineering, December 2010