THE OHIO STATE UNIVERSITY
COLLEGE OF ENGINEERING

Computational Modeling of Additive Manufacturing and Welding

WELDENG 4115

Credit Hours:
3.00

Course Levels:
Undergraduate (1000-5000 level)

Course Components:
Lecture
Lab

Course Description:
Theory of temperature, stress, deformation and phase transformation for additive manufacturing and welding, as well as application of industry-standard simulation codes.

Prerequisites and Co-requisites:
Prereq: 4201, or permission of instructor.

Course Goals / Objectives:
- Develop a basic understanding of the theory of heat transfer, stress and deformation, and phase transformation including the governing partial differential equations.
- Understand the basics of commonly-used numerical methods including finite difference and finite element methods.
- Pose practical problems in terms of physical phenomena, formulate solutions using computational models, and understand the assumptions made as well as limitations of these models.
- Apply industry-standard finite element codes and material modeling software to solve practical additive manufacturing and welding problems.

Course Topics:

- Theory of heat conduction
- Finite difference and element solution to heat conduction
- Theory of residual stresses in AM and welding
- Finite element formulation for 2-D elastic elements
- Origin of residual stresses and deformation
- Advanced topics on metal plasticity
- Solid-State Transformation in Welds
- Computational materials modeling
- Thermodynamics and CALPHAD
- Kinetics of phase transformation
- Mathematics of diffusion
- Experimental Validation

Designation:

Elective