



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.
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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
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Designation:

Elective