

TAM 554 - Theory of Plasticity

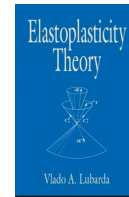
Instructor - Prof. Huseyin Sehitoglu, huseyin@illinois.edu

Class Hours –MW 1-3, Room 214 Ceramics

Office Hours – Open, Room 237 CAB, Computer Applications Building

Recommended Text - Elastoplasticity Theory, V.A . Lubarda, CRC Press 2001

(<http://www.crcnetbase.com.proxy2.library.illinois.edu/isbn/9781420040784>)



The class notes will not correspond exactly to text material. The class notes will be available at <http://html.mechse.illinois.edu/classes/>

We will make references to the above text and others during course coverage.

Grade -	Homework	- 25%
	Mid-term	- 20%
	Project	- 25%
	Final	- 30%

Late homework will not be accepted.

Coverage:

1. New Developments in Plasticity- Examples, Mathematical Preliminaries: Indicical Notation, Tensors, Coordinate Transformations
2. Elastic and Plastic Deformation of Materials ; Microstructural Basis for Plasticity, Stress and Strain Tensors, Unified Stress-strain Relation Example
3. Constitutive Equations in Plasticity: Yield Criteria, Prandtl-Reuss, Hencky Equations, Applications to Tension-Torsion, Normality Conditions, Mroz Rule, Unified Stress-strain Relations
4. Stress Analysis for Combined and Thermal Loading: Cylinders and spheres under pressure and temperature gradients
5. Large Strain Plasticity, Multiplicative Decomposition, Jaumann etc., Review of FEM with Finite Deformations
6. Crystal Plasticity, Single crystals, Slip and Twinning
7. Thermodynamics, First Law and Second Law
8. Drucker Stability Postulate
9. Max Plastic Work Inequality from Slip Theory
10. Non-associated Flow Rules, Bifurcation Theory
11. Strain Gradient Plasticity
12. Plane Strain Slip Line Fields
13. Limit Load Theorems

Recommended Textbooks:

1. J. Lubliner, Theory of Plasticity, Dover, 2008
2. A.S.Argon, Strengthening Mechanisms in Crystal Plasticity, Oxford, 2008
http://vufind.carli.illinois.edu/vf-uiu/Record/uiu_7630871
3. Theory of Flow and Fracture of Solids Vol 1 and Vol 2, A. Nadai, Mc Graw Hill, 1963
4. The Mathematical Theory of Plasticity, R. Hill, Oxford, Reprinted 1989
5. Deformation-Mechanism Maps, H. Frost and M. Ashby, 1982