

AE-6107: Analysis of Aerospace Structural Elements

1 Topics to be covered in this course

The following topics to be covered in this course:

1. *Euler-Bernoulli beam theory*. Review of the basic assumption.
2. *Torsion of beams*. Saint Venant's solution.
3. *Yield criteria*. Introduction to yield criteria. Plastic behavior of trusses. Plastic bending and torsion of beams.
4. *Kirchhoff plate theory*. Theory for isotropic plates. Decoupling into bending and stretching equations. Boundary conditions. Energy methods.
5. *Anisotropic plates*. Classical lamination theory. Governing equations for anisotropic plates.
6. *Classical solutions for plates*. The Navier solution; the Lévy solution. Energy methods for plates.
7. *Mindlin plate theory*. Shearing deformations in plates. Navier solution for shear deformable plates. Energy principles for shear deformable plates.
8. *Von Karman equations*. Governing equations for plates undergoing large displacements and rotations.
9. *Buckling of anisotropic plates*. Compressive and shearing loads. Effects of shearing deformations.
10. *Vibrations of plates*. Effects of shearing deformations and in-plane loads.

2 Grading Policy

The overall numerical grade for this course will be computed using the weighting factors shown in table 1.

10 Homework Assignments	50%
3 Exams	30%
1 Final exam	20%
TOTAL	100%

Table 1: Grade weighting factors

3 Weekly homework

Homework will be assigned on a weekly basis. Homework is assigned on Thursdays lectures and is due the next Thursday, in class. Homework is a vital part of the learning process, and 50% of your final grade. To make sure no homework is *forgotten*, an aging factor will be built into the grading as shown in table 2.

Date homework is turned in	Aging factor
On the due date	actual grade
Up to the Tuesday after due date	actual grade - 1/10
Up to the Thursday after due date	actual grade - 2/10
Never turned in	0/10

Table 2: Aging factor for homework

4 Reference books

The following reference text books are a good source of information for the class: [1, 2, 3, 4, 5, 6, 7, 8, 9, 10].

References

- [1] B.K. Donaldson. *Analysis of Aircraft Structures*. McGraw-Hill, Inc., New York, 1993.
- [2] Shames I.H. and C.L. Dym. *Energy and Finite Element Methods in Structural Mechanics*. Hemisphere Publishing Corp., 1985.
- [3] D.H. Allen and W.E. Haisler. *Introduction to Aerospace Structural Analysis*. John Wiley & Sons, New York, 1985.
- [4] J.T. Oden and E.A. Ripperger. *Mechanics of Elastic structures*. McGraw-Hill, Inc., New York, 1980.
- [5] J.N. Reddy. *Energy and Variational Methods in Applied Mechanics*. John Wiley & Sons, Inc, New York, 1984.

- [6] K. Washizu. *Variational Methods in Elasticity and Plasticity*. Pergamon Press, Oxford, U.K., 1975.
- [7] S.P. Timoshenko and S. Woinowsky-Krieger. *Theory of Plates and Shells*. McGraw-Hill, Inc., New York, 1959.
- [8] G. Wempner. *Mechanics of Solids with Applications to Thin Bodies*. Sijthoff & Noordhoff, The Netherlands, 1981.
- [9] C.Y. Chia. *Nonlinear Analysis of Plates*. McGraw-Hill, Inc., New York, 1980.
- [10] S.P. Timoshenko and J.M. Gere. *Theory of Elastic Stability*. McGraw-Hill, Inc., New York, 1961.