ME 8253 Fatigue in Engineering Design
Fall 2014

Description: Prediction and prevention of fatigue failure in metallic materials.

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Textbook: ***Metal Fatigue in Engineering***
R. I. Stephens, A. Fatemi, R. R. Stephens, and H. O. Fuchs

Grading:

Homework	30%
Mid-term	35%
Final exam (comprehensive)	35%

A: 90-100 B: 80-89 C: 70-79 D: 60-69 F: 0-59

General Class Policies:

- No late homework will be accepted
- No make-up exams will be given
- Homework must be written, organized, and presented in a professional manner

Academic Honesty:

All occurrences of academic misconduct will be dealt with in accordance with guidelines and procedures outlined in the Academic Misconduct Policy, which may be accessed on the web at www.msstate.edu/web/security.html.

Email Policy:

The University has determined that email WILL be an official method of communication with students. Each and every student will have an official email account with MSU. Students must either use this email address or set it up to forward email to another address. ALL students MUST go into Banner and configure their official email address. Students can obtain information on how to configure their email by going to www.its.msstate.edu/student email.

Course Outline:

1. Overview of the History of Fatigue and Fracture
2. Material Stress-Strain Behavior
3. Fatigue Analysis: Stress Based Approach
   - Constant Amplitude Loading
   - Mean Stress Effects
   - Giga-Cycle Behavior
   - Stress Concentration Effects
   - Variable Amplitude Loading
     - Cumulative Damage
     - Rainflow Cycle Counting
   - Multiaxial Stresses
4. Fatigue Analysis: Strain Based Approach
   - Constant Amplitude Loading

- Mean Stress Effects
- Multiaxial Stresses and Strains

5. Fatigue Analysis: Two Stage Approach
   - Local Stress-Strain Approach for Crack Initiation
   - Fatigue Crack Propagation
     - Review of Fracture Mechanics
     - Constant Amplitude Loading
     - Crack Closure
     - Variable Amplitude Loading
     - Fatigue Crack Growth Threshold
     - Fracture
6. Fatigue Life based on Small-Crack Behavior
   - Constant Amplitude Loading
   - Variable Amplitude Loading
7. Increasing Fatigue Resistance
   - Design Details
   - Role of Stress Concentration and Surface Finish
   - Beneficial Residual Stresses
8. Statistical Aspects of Fatigue
9. Fatigue of Connections
   - Bolted or Riveted Joints
   - Welded Joints

References:

Deformation and Fracture Mechanics of Engineering Materials, R. W. Hertzberg
Failure of Materials in Mechanical Design, J. A. Collins
***Mechanical Behavior of Materials*, N. E. Dowling**
Fatigue of Materials, S. Suresh
***Fatigue of Structures and Materials*, J. Schijve**
SAE *Fatigue Design Handbook*, AE-22
Fundamentals of Metal Fatigue Analysis, J. A. Bannantine, J. J. Comer, and J. L. Handrock
Fatigue Damage, Crack Growth and Life Prediction, F. Ellyin