ENRE 641
Probabilistic Physics of Failure and Accelerated Testing
(Fall 2018)

Important Dates:

Midterm Exam: 18 October, 2018 (Also, a one-hour Review Session on 11 October)
Review Session and Project Due Date: 6 December, 2018

Instructor: Prof. M. Modarres, modarres@umd.edu, Office Hours: 2:00-3:00 PM Thursdays, Telephone: 301-405-5226.

Grading:

Midterm (open book): 25%
Six Homework: 15%
Project: 25%
Final Exam (Take home): 35%

Required Textbook:


Also, class notes are posted and you need to regularly check for updates, assignments, and announcements.

Additional Recommended References:


Overview of Probabilistic Physics-of-Failure Approach to Reliability

Introduction
Overview of Physics-of-Failure Modeling
Important Forms of PoF Models
PPoF Approach to Life Assessment
Accelerated Testing in PPoF Model Development
Organization of the Book
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Summary of Mechanisms of Failure and Associated PoF Models

Introduction
Fatigue
  Life-stress
  The S-N Diagram
  Mean Stress Effects
  Combined Loading
Strain-Life
  Monotonic Stress-Strain Behavior
  Cyclic Stress-Strain Behavior
  Strain-Life Relationship
  Mean Stress Effects
Variable Amplitude Loading
  Non-Linear Damage Models
Notch Effect
  Life-stress
  Strain-Life
Two-Stage Approach to Fatigue Life Estimation
Fracture Mechanics
  Stress Intensity Factor
  Region I
  Region II
  Region III
  Fracture Mechanics Approach with Notch Effect
Factors Influencing Fatigue Failure
  Size Effect
  Frequency Effect
  Environmental and External Effects
  Miscellaneous Factors
Wear
  General Form of Wear Equations
  Sliding Wear
  Abrasive Wear
  Impact Wear
  Rolling Wear
  Life Models for Bearings
Maximum Likelihood Approach to Estimating Acceleration Degradation Model Parameters
Bayesian Estimation of ADT Model Parameters

Accelerated Test Planning
Introduction
Issues to Consider Prior to Accelerated Testing
Planning for Accelerated Life Tests
Steps for Accelerated Life Tests
Optimal Design of Accelerated Life Test
Planning for Accelerated Degradation Tests

Accounting for Uncertainties and Model Validation
Introduction
Uncertainties in Evidence
PPoF Model Uncertainties, Errors, and Validation
Applications of Model Validation in ADT