Course Title: Reliability Engineering   Spring 2015

Course: SIE 408/508

Instructor: Dr. Haitao Liao, Associate Professor  
Systems and Industrial Engineering Department  
University of Arizona  
Office: 223 Engineering Building  
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GTA:  
Mr. Hongwei Luo  
Office: Old Engineering Building 159A  
Office hour: 1:30-3:00 pm Tuesday and Thursday  
E-mail: harveyluo@email.arizona.edu  


Software: Weibull++7, XFMEA, and BlockSim7 from ReliaSoft  
(Licenses are available, free to use in class); MS Excel  

Course Description and Goals:  
This is a three-credit course configured for well-qualified seniors, graduate students, and engineering professionals and practitioners. It is concerned with determining the probability that a component or system, whether simple or complex, will function as intended. The scope of this course includes: (1) Root cause analysis of critical failures, (2) reliability models of components and systems, (3) development of statistical methods for estimating the reliability of a product, (4) use of software tools to perform model development and analysis, and (5) methodologies to influence system designs.

After successful completion of the course the students will be able to analyze data related to reliability questions and use the analytical results to predict the reliability of simple and complex systems. This course will provide an introduction to probability calculus for continuous and discrete random variables, statistical failure time models, estimation of model parameters, model comparison and prediction of future failures. Reliability for simple and complex systems and the relationship to component reliability will be discussed. Students will practice application of the theoretical techniques with data sets from different engineering disciplines using the commercial software provided in this class.

Graduate-level requirements include a term project that focuses on real-world implementations of the course material and/or original theoretical developments in the
form of a technical paper. Project topics (e.g., system reliability optimization, physics-based reliability models, warranty data analysis) must be approved by the instructor.

**Prerequisite:**
For undergraduate students: SIE 305 or equivalent; For graduate students: SIE 430/530.

**Topics to be covered:**
- Basic concepts in Reliability Engineering
- Root cause analysis
- Statistical reliability models
- System reliability analysis & optimization
- Life time data analysis & model parameter estimation

**Contribution to Professional Component/Learning Outcomes:**
1. Understand and gain the ability to apply concepts and methods of reliability analysis to failure data from different engineering disciplines.
2. Understand and be able to develop probability distribution models (exponential, Weibull, etc.) for failure time analysis.
3. Understand various statistical methods used in reliability analysis. The main focuses are model parameter estimation methods (maximum likelihood, least squares), various statistical tests (e.g., Mann’s test, KS test, etc.), and graphical methods for model validation (e.g., Weibull plot, Q-Q plot, etc.).
4. Acquire ability to apply statistical methods to the prediction of reliability and failure for technological systems and their components.
5. Acquire ability to model system reliability.
6. Understand contemporary unsolved technical problems in reliability analysis.

**Proctor Information:**
This course will have proctored exams for distance students. It is the student’s responsibility to locate a proctor and report this information to the distance education department.

**Grading (different criteria will be used for UG and Grad students):**

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It is expected that grading will be based on a percentage of the total points possible with the following minimums required for each grade: A = 90%, B = 80%, C = 70%, and D = 60%.

Homework will be assigned approximately one week before it is due. **NO LATE HOMEWORK WILL BE ACCEPTED.** If you cannot attend class, make sure your homework is e-mailed to the GTA or delivered to my office (310 Engineering Building)
before class on the day it is due. Homework not turned in on time will be graded as zero, so please turn in what you have completed even if you have not fully completed an assignment.

Suggested References

Websites:
1.  www.reliasoft.com
2.  www.maintenancetechnology.com
3.  www.reliabilityweb.com
4.  www.barringer1.com/

Books: