University of Maryland
Reliability Engineering
Curriculum: Structure and Philosophy

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Reliability Engineering Graduate Program

- Comprehensive education and research activities in risk, reliability, and safety of engineered systems and processes

- Offering MS, PhD, and Graduate Certificate in Reliability Engineering

- Over 20 Graduate Courses in diverse areas of risk, reliability and safety

- 30 years of existence, 25 years of which as a formal degree offering discipline in the A.J. Clark School of Engineering
RELIABILITY ENGINEERING CURRICULUM STRUCTURE

- Systems Reliability Specialization
- Intermediate and Common Electives
- Microelectronics Reliability Specialization
- Risk Analysis Specialization
- Software Reliability Specialization
- Core
Major Courses Offered

CORE AND INTERMEDIATE COURSES
• Fundamentals of Failure Mechanisms
• Reliability Analysis
• Fundamentals of Reliability Engineering
• Mathematical Techniques of Reliability Engineering
• Probabilistic Physics of Failure and Accelerated Testing
• Advanced Methods in Reliability Modeling

TECHNICAL ELECTIVES
• Collection and Analysis of Reliability Data
• Reliability Engineering Management
• Microelectronics Device Reliability
• Probabilistic Risk Assessment
• Risk Management for Engineers
• Software Reliability and Integrity
• Information Security
• Other Interdisciplinary elective tracks meet needs of engineering community (i.e. take electives in Systems Engineering, Project Management, etc.)

Research Courses
• Independent Studies in Reliability Engineering
• Master Thesis
• Ph.D. Thesis
Faculty

**Current Core Faculty (ME)**
- Professor Aris Christou
- Associate Professor Michel Cukier
- Minta Martin Professor Mohammad Modarres
- Nicole J. Kim Professor Ali Mosleh
- Associate Professor Jeffrey Herrmann
- Assistant Professor Monifa Vaughn-Cooke
- Professor of the Practice Jeong Kim

**Emeritus Professors**
- Professor Marvin Roush
- Professor Vincent Brannigan (FPE)

**Affiliate Faculty**
- Professor Shapour Azarm (ME)
- Professor Neil Goldsman (ECE)
- Professor Bilal Ayyub (CEE)
- Professor Gregory Beacher (CEE)
- Professor Peter Sandborn (ME)
- Associate Professor Linda Schmidt (ME)
- Professor Peter Sandborn (ME)
- Professor Carol Smidts (ME, OSU)
- Professor Joseph Bernstein (ECE, Israel)

**Adjunct Faculty and Lecturers**
- Dr. Stuart Katzke (NIST)
- Dr. Nathan Siu (NRC)
- Dr. Norman Eisenberg (Independent Consultant)
- Dr. Mark Kaminiskiy (CRR-CEE)
- Dr. Roy Schuyler (Independent Consultant)
Centre for Risk and Reliability (CRR)

• An umbrella organization for many of the risk and reliability research and development activities in the A.J. Clark School of Engineering

• 23 Full Time, Adjunct, and Affiliate Faculty

Diagram:

- Systems
- Processes
- People/Organizations
- Information

Common Set of Principles and Techniques
CRR Research

- 45% Complex Systems
- 30% Physics of Failure
- 25% Analytical Models

- Human 18%
- Software 22%
- Hardware 32%

- Experimental
- Theoretical / Simulation
CRR Research Laboratories

- Hybrid Systems Reliability Laboratory
- Human Reliability Laboratory
- Probabilistic Physics of Failure and Fracture Mechanics Laboratory
Examples of Research Areas

- Complex Systems Reliability
- PHM and applications to Structural Integrity
- Probabilistic Physics of Failure
- Microelectronics Reliability
- Data Analysis and Predictive Models
- Human Reliability
- Cyber Security
Our Philosophy for Reliability Education and Research

Risk Assessment Models

System Reliability Models

"The Lambda Line"

Mechanistic & Probabilistic Physics of Failure Models and Data

Past Data

Physics Data

Component Reliability Models
CRR Research Partnerships

*Cooperative Research Agreements with government agencies:*
- US NRC
- US Navy
- NASA
- EC Halden Research Center, Norway
- EEC Joint Research Center, Italy
- ETH Center for System Safety, Switzerland
- Norwegian Institute of Technology
- Paul Scherrer Research Institute, Switzerland

*Partnership with the industry:*
- ManTech
- Reliability Information Analysis Center (RIAC) Partnership
Reliability Engineering for Professionals and Distance Education

Degree Seeking:

- Professional Master of Engineering Program (requires the completion of 10 courses with NO thesis, scholarly paper, or comprehensive exam)
- Graduate Certificate in Engineering Program (requires the completion of 4 courses, highly focused, either as stand-alone or as stepping-stone to a master’s)

Non-Degree Seeking:

- Taking Courses Ad Hoc (as relevant or needed for individual)
Distance Education Technology & Services (DETS)

- On Campus Technology Enhanced Classrooms
- Classes Webcasted
- Courses Delivered Synchronously to Regional Remote Sites
- 100% Online Course Delivery
- Video Chat, Threaded Discussions, Posting Sites for Collaboration, Virtual Team Projects
UPCOMING 25th ANNIVERSARY SYMPOSIUM AS A FORMAL RELIABILITY ENGINEERING PROGRAM—APRIL 2, 2014

AGENDA
WEDNESDAY, APRIL 2, 2014
University of Maryland Reliability Engineering Symposium
Opening Remarks and Panel in Memory of Hans \textit{et al.}, 9:00 AM, Hemlock Ballroom, University of Maryland
University of Maryland Reliability Engineering Symposium
25th Anniversary Reception and Awards Presentation, 5:30 PM, Hemlock Ballroom, University of Maryland

UPCOMING 25th ANNIVERSARY SYMPOSIUM

25TH ANNIVERSARY SYMPOSIUM
Ppem of a Discipline Reliability and Risk in Theory and Practice

RELIABILITY ENGINEERING
1989-2014

APRIL 2, 2014
Second Floor, Alumni Center
University of Maryland
College Park, Maryland