

Computers and Nuclear Energy - Fall 2011

- **EECE 499-01**
 - CRN 89834
 - 3 credit hours
 - R 2:10 – 5 pm
 - LKD 3113
- **Instructor**
 - Dr. Charles Kim and Dr. Peter Keiller
 - (202)806-4821
 - ckim@howard.edu
 - Office Hours (LKD3014)
 - T 2:00 – 4:00 pm
 - W 4:00 – 5:00 pm
 - Scheduled appointment
- **Class Assistants**
 - Ravi Jaglal, Will Reed, and Kidan Fenta
- **Web ---Syllabus, Notes, etc**
 - www.hirstbrook.com

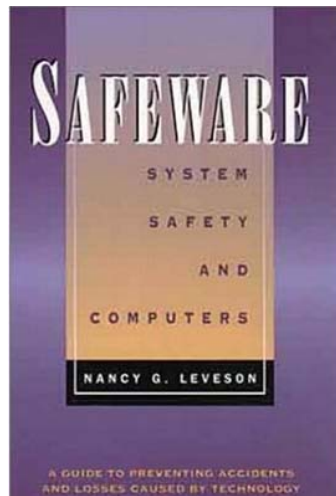
Why Computers and Why Nuclear Energy

- **Why Computers**
 - Ubiquitous computing
 - Embedded Computing
 - Computer/Digital System Control
 - Are computers reliable?
- **Safety-Critical System**
 - Safety is the highest priority
 - A failure or accident causes substantial amount of damage
 - But failures are rare
 - Computer controlled
 - Example: Nuclear power system, aircraft control system, petrochemical plant, oil exploration, nuclear weapon system, etc
 - We choose Nuclear Energy as the backdrop of the safety-critical system

Course Objectives Topics

- Objectives
 - Understanding of general nuclear science and engineering concepts
 - Defense-in-Depth of computer
- Topics of the Course
 - Nuclear System Fundamentals & Nuclear Power System Safety (Parallel Guest Lectures)
 - Computer (H/W and S/W) reliability problems in mission critical systems
 - Investigation of Accidents caused by H/W or S/W
 - Defense-in-Depth of Computer Systems for System Safety

Main Text and Resource



- **Textbook**
 - None
- **Related book**
 - “Safeware – System Safety and Computers” by Nancy Leveson
 - published by Addison-Wesley
 - ISBN: 0-201-11972-2
 - ***NOTE: Used book is cheap**
- **Other Resources**
 - Handouts
 - Book excerpts
 - Articles
 - Reports

Course Grading and Expectation

- **Expectation**
 - Attendance
 - Active Participation
 - Reading Assignments
 - Writing Essay or Report
 - Everything counts
 - Professional manner
 - Courteous and respectful to guest speakers
- **Grading**
 - Attendance (10%): only on-time arrival counts
 - Reading + Essay + Report (50%)
 - Class activities: Lecture summary (30%) – Understanding the core concepts of the guest lectures
 - -Other Assignments (10%)
- **Grades**
 - **A: 90 – 100**
 - **B: 80 – 89**
 - **C: 70 – 79**
 - **D: 60 – 69**
 - **F: 0 - 59**

Class Schedule (Parallel)

- **Class**
 - Computer-caused/related accident investigation
 - H/W and/or S/W
 - Defense-in-Depth Concept
 - Hardware Diversity
 - Software Reliability
- **Guest Lectures**
 - 9 guest lecturers from NRC
 - **Subjects**
 - Reactors
 - Digital Instrumentation and Control
 - Security of NPP
 - Cyber security
 - Licensing Process
 - Fukushima

Guest Lecture Series – Sponsored by NRC

- **01 SEP 11**
 - New reactors and small modular reactors [Pamela Longmire & Tanya Hood]
- **08 SEP 11**
 - Digital I&C (and Method of Defense-in-Depth in reactor protection) [Deirdre Spaulding-Yeoman]
- **15 SEP 11**
 - Security and safeguards of NPP to include EP [Edward Robinson & Kirk Foggie]
- **22 SEP 11**
 - Nuclear criticality and nuclear engineering [Tamara Powell & Nateron Jordan]
- **29 SEP 11**
 - Power Upgrades [Pamela Longmire]
- **06 OCT 11**
 - Power generation and Electrical Components [Ronaldo Jenkins]
- **13 OCT 11**
 - Cyber Security [Deirdre Spaulding-Yeoman]
- **20 OCT 11**
 - NPP Licensing Process [William "Butch" Burton]
- **27 OCT 11**
 - Accident Analysis of Japan's Fukushima Daiichi reactors [Gregory Suber & Stephanie Bush-Goddard]

Friendly Fire and IFF Intermittency Problem

- April 14, 1994
- Iraq
- No Fly Zone
- AWACS (Airborne Warning and Control System)
- F-15 fighters
- UH-60 Helicopters
- 26 Peacekeepers killed
- Many approaches to understand the incident
 - Social and organizational approach
 - My view: component intermittency of IFF (Identification Friend or Foe)



Honda Recall

- Reuters on August 8, 2011
- “Honda recalls 2.5 million cars and SUVs”
- “to repair a software problem that could damage the automatic transmission”
- “Without updating the software, the automatic transmission in these vehicles could be damaged if the driver quickly shifts between gears. That might cause the engine to stall or make it difficult to put the car into park”
- “It's software programming. It's not a weakness in the transmission per se.” – Honda Spokesman

Transmission Software



Honda recalling 2.26M vehicles world-wide over automatic transmission failure



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Homework 1

- Investigation of a computer related accidents in safety-critical system
 - Nuclear Power
 - Nuclear Medicine
 - Aircraft and Aerospace
 - Petrochemical process
 - others
- Search and find an incident computer (H/W and/or S/W) caused and write a report on the incident with:
 - What happened, how happened, why happened?
- Individual Work
 - Cannot report on the same incident
 - Once you find one and email me and get approval so that others who find the same thing later do search again,
- Written report (hardcopy + softcopy)
 - Concise, technical, professional, WP staff writer-like report, with your own words --- Important things in the first paragraph
 - Letter size, 1” margin all sides, 10 pt. Times New Roman font. Single space. Min 1, Max 2 pages.
 - Due: W 01SEP11

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