

# Report

Dear Sir or Madam,

We appreciate for your cooperation.  
We would like to utilize feedback from your opinion in the near future.  
Please make a report on your lecture in English.  
This report will be posted on the website of Hiroshima University.

Sincerely,

Graduate School of Engineering, Hiroshima University

**(1) Name of Lecturer:** Yashwant K. Malaiya

**(2) Position:** Professor

**(3) Affiliation:** Computer Science Dept, Colorado State University, USA

**(4) Short Biography:** Yashwant K. Malaiya is a professor in the Computer Science Department at Colorado State University. He has published more than 160 papers in the areas of fault modeling, software and hardware reliability, testing and testable design, and quantitative security risk evaluation. He served as the General Chair of 1993 and 2003 IEEE International Symposium on Software Reliability Engineering (ISSRE). He co-edited the IEEECS Technology Series book Software Reliability Models, Theoretical Developments, Evaluation and Applications. He is a recipient of the IEEE Third Millennium Medal and the IEEE Computer Society Golden Core award. Concepts developed by him include "Detectability Profile", "Antirandom Testing", the MD coverage based model and the AML Vulnerability Discovery Model. His research interests include fault modeling, software and hardware reliability, testing and testable design, and quantitative security risk evaluation.

**(5) Subject and Schedule of the Lectures:**

This series of lectures was a part of the course "Software Reliability Engineering" hosted by the Institute of Engineering at the Hiroshima University. The objective was to explore multiple aspects of software reliability engineering using the ideas that have developed in recent years, which includes some of the research we have published.

August 8 (Monday) L1: Why software reliability, Defect Density 8:45-10:15 **Topics:** Techniques available in Software Reliability, Software & Hardware Reliability, Defect density & factors that control it, Phase, Programming team and process maturity, Software Structure, Requirement volatility, Reuse, Impact of Module size

August 9 (Tuesday) L2: Reliability Analysis, Fault testability. 8:45-10:15 **Topics:** Reliability measures, Reliability, availability, Transaction Reliability, MTTF and R(t), MTBF Basic Cases, Single unit with permanent failure, failure rate, Single unit with temporary failures, Combinatorial Reliability, Block Diagrams, Serial and parallel (redundant) Fault detectability, Detectability Profile, Hard-to-test vs easy-to-test faults.

August 9 (Tuesday) L3. Software Reliability Growth, Time vs Coverage based models. 10:30-12:00 **Topics:** Testing approaches, Operational Profile, Software Reliability Growth Models, Exponential and Logarithmic, Model evaluation: error, bias, Model usage, Static estimation before testing, Making projections using test data, Coverage based modeling.

August 10 (Wed.) L4. Multi-component systems, reliability allocation 8:45-10:15 **Topics:** Software system: number of modules, Individual modules developed and tested differently, different defect densities and failure rates, Sequential execution, Concurrent execution, N-version systems, Reliability allocation.

August 10 (Wed.) L5. Applying Software Reliability concepts to Quantitative Software Security 10:30-12:00 **Topics:** Vulnerabilities and the society, Risk as Likelihood x Impact product, Vulnerability discovery in lifecycle, Vulnerability

Discovery models, CVSS as a risk measure, Measuring impact, Vulnerability markets.

**(6) Comments:**

A total of about 8 students participated. They included graduate students from the Division of Information Engineering including those associated with the dependable computing group. We discussed some of the questions that need further research.

**(If possible, please attach photos of your lecture.)**