Faults on Its Sleeve
- Amplifying Software Reliability Testing

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In this talk…
♦ Background
♦ Pro forma abstract
♦ Paper summary
♦ Paper evaluation

Background
♦ 1956 Debugging-Oriented
♦ 1957 - 1978 Demonstration-Oriented
♦ 1979 - 1982 Destruction-Oriented
♦ 1983 - 1987 Evaluation-Oriented
♦ 1988 - Prevention-Oriented
♦ This paper: 1993

Pro forma abstract
♦ How it fits Newman’s framework:
  – Enhanced Model?
  – Novel idea?
  – New Technique?
♦ The Abstract:
  – The connection of software quality measures with defects and with the development process is little understood. Direct reliability assessment by random testing of software is impractical. Reliability amplification, a new way of looking at the software reliability problem is described. By amplifying the significance of reliability testing, it is feasible to demonstrate that the actual reliability is better than the measurement. The idea is illustrated with a simple example, and is evaluated by comparing with conventional reliability testing techniques.
Reliability Amplification

- Yes, software quality is important
- Popular approaches:
  - software process
  - formal methods
- Common failing:
  - no established relationship between the method and its quantitative assessment
- Expectation to reliability analysis:
  - Show that actual reliability is better than the measurement
  - Be quantitative so that the reliability measurement can be calculated

Conventional Reliability Measurement

- Description:
  - To estimate software reliability, chooses test points at random according to an operational profile (oracle).
- Theoretical Terms:
  - MTTF: mean time to failure
  - \( \Theta \): a meaningful long-term failure rate
  - N: number of tests
  - 1- \( \alpha \): upper confidence bound
  - \( \theta \): some concrete long-term failure rate

Testability Analysis

- Testability:
  - the probability of a program \( P \) that if \( P \) contains fault(s), \( P \) will fail under test.
- Sources of faults (conversion probabilities):
  - Execution conditions
  - Infection conditions
  - Propagation conditions
- Suggestion from the author:
  - Design for high testability, then test to uncover failures. When no more are found, there are less likely to be hidden ones that have been missed.

Reliability Amplification using Testability

- Popular belief:
  - Software is more reliable than the smallest upper bound for which testing with adequate confidence is practical.
- To quantify this:
  - With testability
  - And amplify the reliability measurement.
The rest of the paper…

- Critique of the amplification example
- Application suggestions:
  - Systematic testing
  - Formal methods
  - Software process
  - Self-testing

Paper evaluation

- What did I get from this paper:
  - An idea, possibly good and applicable
  - Good critique and analysis of existing testing models
- Except for these…
  - No validation at all!
  - Doubtful topic: space is almost evenly divided among all sections
  - Confusingly organized
- Thoughts on selecting reference papers:
  - How do we know if a paper is bad before reading thru it?
    - Number of citations?
    - Public place?