PANEL ON FAULT REPRESENTATIVENESS

**GOAL**: to discuss fault injection representativeness in the context of dependability benchmarking.

**SOME QUESTIONS**:

- If dependability benchmark is a test (or set of tests) to quantify computer dependability, what is different from traditional fault injection experiments?
- Which classes of faults are relevant?
- How to create a representative mix of classes of faults (let us call it faultload)?
- How to include external features (environment, operation conditions, etc) in the faultloads?
- What is the meaning of ‘representative’ in this context?
- Is fault representativeness to be discussed in a statistical basis or is the representativeness of a particular fault also important?
Fault representativeness

Faults themselves?

➢ Stuk-at faults for hardware?
➢ Code mutations for software?

Inject faults are not representative of real faults

Fault injection or error injection?

➢ Are injected faults similar to errors produced by real faults?
  e.g. in SWIFI for hardware faults

Effects of faults, i.e. errors?

➢ Relationship between injected faults and real faults is via the produced errors only, in their ability to trigger error-detection and system recovery mechanisms
➢ Do simple (injected) faults produce errors similar to real faults?
➢ External faults ➟ « robustness testing »
Representativeness of software mutations

Analysis of the complete mutation data base versus the real fault data base

Analysis of the distinct error sets

Mutation-DB
(349 distinct errors)

Real fault-DB
(255 distinct errors)

❉ development, not operational, faults
Detection by the hardware EDMs

Fault injection in MARS

- No Application-level EDMs
- Message Checksum only
- Checksum & Double Execution

Heavy Ions, Pin Forcing, Electromagn. Interference, Software Controls, Software Data

* no error analysis
SOME QUESTIONS:

- If dependability benchmark is a test (or set of tests) to quantify computer dependability, what is different from traditional fault injection experiments?

  ☝️ Coverage is not the focus point ➔ dependability measures

- Which classes of faults are relevant?

  ☝️ All of them: physical int. & ext., design, human interaction

- How to create a representative mix of classes of faults (let us call it faultload)?

- How to include external features (environment, operation conditions, etc) in the faultloads?

- What is the meaning of ‘representative’ in this context?

  ☝️ Think in terms of errors

- Is fault representativeness to be discussed in a statistical basis or is the representativeness of a particular fault also important?

  ☝️ Definitely statistical, in terms of errors