

Some ideas for Case Study topic selection

Various databases:

- Citeseer: <http://citeseer.ist.psu.edu/>
- ACM Digital Library: <http://portal.acm.org/dl.cfm>
- IEEEXplore: <http://ieeexplore.ieee.org/>
- SpringerLink: <http://www.springerlink.de/>
- ISI Web of Science: <http://isiknowledge.com/>

Most of the databases (ACM, IEEE, Springer and ISI) are available only within the campus network. For remote access please use toru.ttu.ee services (https://wiki.ttu.ee/it/en/doc/lib_toru)

Some additional links:

- Accident Databases: <http://www.ntnu.edu/ross/info>
- ACM Risks Forum: <http://catless.ncl.ac.uk/Risks/>

Examples (just to stimulate your thinking)

- Arriving agreement in interconnected systems - algorithm implementations and relative performances
- bio-computing, alternative technologies (such as high risk technologies)
- Quantum Computing
- Provide an alternative classification of software fault-tolerant techniques. Includes a survey of all methods such a classical methods (N version programming, recovery block) and methods more often used in practice such as checkpointing, shadowing, etc.
- Clock synchronization
- Atomic and reliable broadcast
- Algorithmic based fault-tolerance
- System level diagnosis - distributed algorithms
- Fault-tolerant transaction processing systems
- Measures of software reliability
- Validation and verification techniques
- Modeling and evaluation tools
- Fault injection methods
- Fault tolerance in wireless systems

- Fault tolerance and reconfigurable memory systems
- MEM based systems and fault-tolerance requirements
- Reconfiguration for fault-tolerance (use of FPGAs)
- Evaluation tools such as SHARP and USAN - compare and contrast

- Survey of rollback-recovery techniques in wired and wireless networks
- Fault tolerance in wireless systems
- A fault model for SETI-style distributed computing
- Reducing Cross-coupling effects using bit ordering
- Crosstalk aware fault-tolerant techniques
- Fault tolerance in modern operating systems
- Characterizing non-determinism in cores of future processors
- Fault tolerant techniques for on chip cache memory
- Routing in systems with faulty nodes/links
- Bio-inspired fault tolerance for cellular arrays
- Bit-sliced architecture for fault tolerance
- Software testing and verifiable system design
- Fault tolerant sensor network algorithms and techniques
- Fault Tolerant real-time systems
- Case Study: IBM S390 system - fault tolerance and availability
- On-line testing for fault tolerance
- Evaluating fault tolerant techniques for superscalar processors
- Fault-Tolerance in E-Commerce Web Servers
- Incorporating fault tolerance in reconfigurable architectures
- The fault-tolerant FFT butterfly network
- Extended life span testing
- Linux application fault tolerance
- Encoding for crosstalk tolerance busses
- Fault Tolerance in Automotive X-by-wire
- Survey of fault-tolerant techniques in modern micro-processors
- Fault-tolerance in Quantum Computing
- Performance and reliability analysis of RAID-based memories

Some ideas (!) for topics:

- Nov/Dec 2008 issue of IEEE Design & Test of Computers magazine dealing with reliability
- IEEE Transactions on Computing - Dec 2008 issue: deals with parallel applications
- IEEE Transactions on Computing - Jan 2009 issue: deals with nanowire decoders
- Architecture level fault-tolerance - see papers in IEEE Micro 41, ASPLOS 2008

- Reducing storage burden via data deduplication (IEEE Computer, Dec 2008, pp 15-17): its impact on fault-tolerance and compare with other methods such as data compression or mixing of data-deduplication and file compression.
- Output commit level fault-tolerance using Condor in combination with forward recovery (different from forward recovery through checkpointing)
- Fault tolerance in wired and wireless systems - for example use of network coding
- Evolution of homogeneous systems into heterogeneous systems in the presence of faults and reconfiguration capability.
- Nano tubes
- RAID Levels, Architectures and Relative Performance
- Numerous papers including a paper (see ref below) dealing with separable codes
 - (Feng, Deng, Bao, and Shen, "New and efficient MDS array codes for RAID Part I: Reed-Solomon-Like Codes for Tolerating Three Disc Failures", IEEE Transactions on Computers, Sept 2005.)
- Self Checking
 - "state" checker based method
 - Refs: ITC paper by Mitra in the conference Proc of 2000
 - Special Issue of JETTA - August 2005 has two papers on this topic
 - An annual conference "IEEE Online test conf" can be rich source of papers in this area.
- Check pointing, Rollback, Roll-forward
 - A some what recent ref is Ssu, Fuchs, and Jiau, IEEE TC Feb 2003
- Routing and reconfiguration in systems with faulty nodes/links
 - Aversky and Natchev, "Dynamic reconfiguration in computer clusters with irregular topologies in the ...", IEEE TC, May 2005
- Fault tolerance in cellular networks
 - Yang et. al "A fault-tolerant distributed channel allocation scheme for cellular networks", IEEE TC, May 2005
- Crosstalk tolerant bus encoding schemes
- Life span computation using multiple voltage and multiple frequency controls
 - Weglarz, Saluja and Mak, "Testing of hard faults in simultaneous multithreaded processors," International On-Line Test Symposium, June 2004.
- Use of recursive redundancy to improve reliability
 - IEEE Design and Test, Aug/Sep 2005
- Fault tolerant methods in modern speculative processors
- Comparative study of reliability and performance evaluation tools

- Tandam/Compaq: Prepare a survey of the fault tolerance techniques of the Compaq NonStop Himalaya Servers.
 - (expand it to widen the scope and include more recent products of various manufacturers of ICs and systems)
 - <http://himalaya.compaq.com/view.asp?IOID=565#2>

- Fault tolerant in Automotive systems: Prepare a survey of fault tolerance techniques that are used in automobiles. Include systems like engine management, drive by wire and steer by wire.
 - A System-Safety Process for By-Wire Systems Delphi Secured Microcontroller Architecture Motronic Engine Management.
 - <http://www.delphi.com/>
 - <http://delphi.com/news/techpapers/> contains all tech publications
- Fault-tolerant features of modern processors - compare and contrast you may look at the websites of Intel, IBM, HP, Sun, etc.

- Software Testing
- Tools and Demos of software testing -
 - The book by Lyu, "software reliability engineering" and many conferences and web should provide a rich resource

- Use of on-line testing methods in hardware fault-tolerance
 - There is an annual workshop that deals with this issues
 - "IEEE On-line testin symposium "
- Hardware defect tolerance
 - See many papers by Koren

- Fault detection techniques:
 - Signatures
 - Nahmsuk Oh, P. P. Shirvani, and E. J. McCluskey, "Control-Flow Checking by Software Signatures", IEEE Trans. on Reliability, 51(2), 111-122, 2002.
 - Jien-Chung Lo et al., "An SFS Berger Check Prediction ALU and Its Application to Self-Checking Processor Designs", IEEE Trans. on Computer-Aided Design of Integrated Circuits and Systems, 11(4), 525-540, 1992.
 - Watchdogs
 - A. Benso et al., "A Watchdog Processor to Detect Data and Control Flow Errors", Proc. 9th IEEE On-Line Testing Symp., 144 - 148, 2003.
 - G. Miremadi and J. Torin, "Evaluating Processor-Behaviour and Three Error-Detection Mechanisms Using Physical Fault-Injection", IEEE Trans. on Reliability, 44(3), 441-454, 1995.
 - Assertions
 - O. Goloubeva et al., "Soft-error Detection Using Control Flow Assertions", Proc. 18th IEEE Intl. Symp. on Defect and Fault Tolerance in VLSI Systems, 581-588, 2003.
 - P. Peti, R. Obermaisser, and H. Kopetz, "Out-of-Norm Assertions", Proc. 11th IEEE Real-Time and Embedded Technology and Applications Symp., 209-223, 2005.
 - Duplication

- Nahmsuk Oh, P. P. Shirvani, and E. J. McCluskey, "Error Detection by Duplicated Instructions in Super-Scalar Processors", *IEEE Trans. on Reliability*, 51(1), 63-75, 2002.
- Nahmsuk Oh and E. J. McCluskey, "Error Detection by Selective Procedure Call Duplication for Low Energy Consumption", *IEEE Trans. on Reliability*, 51(4), 392-402, 2002.
- M. A. Goma and T. N. Vijaykumar, "Opportunistic Transient-Fault Detection", *IEEE Micro*, 26(1), 92-99, 2006.
- Memory protection codes
 - L. Penzo, D. Sciuto, and C. Silvano, "Construction Techniques for Systematic SEC-DED Codes with Single Byte Error Detection and Partial Correction Capability for Computer Memory Systems", *IEEE Trans. on Information Theory*, 41(2), 584-591, 1995.
 - P. P. Shirvani, N. R. Saxena, and E. J. McCluskey, "Software-Implemented EDAC Protection against SEUs", *IEEE Trans. on Reliability*, 49(3), 273-284, 2000.
- Current monitoring
 - Y. Tsiatouhas et al., "Concurrent Detection of Soft Errors Based on Current Monitoring", *Proc. Seventh Intl. On-Line Testing Workshop*, 106-110, 2001.
- Fault tolerance techniques
 - Re-execution
 - N. Kandasamy, J. P. Hayes, and B. T. Murray, "Transparent Recovery from Intermittent Faults in Time-Triggered Distributed Systems", *IEEE Trans. on Computers*, 52(2), 113-125, 2003.
 - Rollback recovery
 - S. Punnekkat and A. Burns, "Analysis of Checkpointing for Schedulability of Real-Time Systems", *Proc. Fourth Intl. Workshop on Real-Time Computing Systems and Applications*, 198-205, 1997.
 - Ying Zhang and K. Chakrabarty, "A Unified Approach for Fault Tolerance and Dynamic Power Management in Fixed-Priority Real-Time Embedded Systems", *IEEE Trans. on Computer-Aided Design of Integrated Circuits and Systems*, 25(1), 111-125, 2006.
 - Active and passive replication
 - Y. Xie et al., "Reliability-Aware Co-synthesis for Embedded Systems", *Proc. 15th IEEE Intl. Conf. on Application-Specific Systems, Architectures and Processors*, 41-50, 2004.
 - KapDae Ahn, Jong Kim, and SungJe Hong, "Fault-Tolerant Real-Time Scheduling Using Passive Replicas", *Proc. Pacific Rim Intl. Symp. on Fault-Tolerant Systems*, 98-103, 1997.
 - Transparency
 - N. Kandasamy, J. P. Hayes, and B. T. Murray, "Transparent Recovery from Intermittent Faults in Time-Triggered Distributed Systems", *IEEE Trans. on Computers*, 52(2), 113-125, 2003.