**ELEC 7950-001: VLSI Design & Test Seminar**

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**Evaluating Impact of Soft Errors in an Embedded System**

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Embedded circuits form an essential part of the electronic control units (ECU) that, nowadays, can be found in almost all automobiles. A soft error in such systems can be life threatening to the end users. Embedded systems, unlike generic systems, have a limited application space as their functionality is predefined. Also, since their outputs often have a qualitative interpretation, embedded systems have the ability to "tolerate" certain errors. In this work, we demonstrate that a more cost effective soft error mitigation solution can be achieved in an embedded system (as compared to a general purpose one) by making use of application level masking and error tolerance limits. For this purpose, we make use of an existing fault injection framework to perform fault analysis on an enhanced pulse width modulator, developed by Texas Instruments Incorporated for a known critical application, by random fault injection into the embedded system hardware. Components, in which the injected fault resulted in an error that is beyond the set tolerance band, are identified as safety critical and need to be 'radiation hardened' in order to mitigate soft error impact. Results show that, for the application considered, ~15% of the sequential logic was safety critical whereas failures in combinational logic were negligible. Although these results are application specific, the worst case scenario would only be the same as radiation hardening a generic system (i.e., all the hardware identified as safety critical).

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