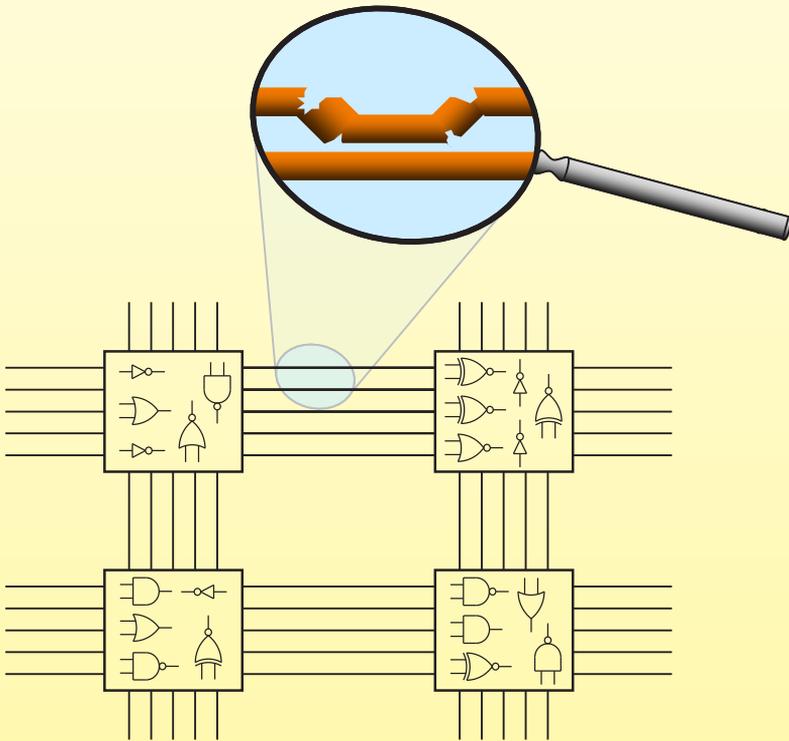


Testing and Logic Optimization Techniques for Systems on Chip

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Today it is possible to integrate more than one billion transistors onto a single chip. This has enabled implementation of complex functionality in hand held gadgets, but handling such complexity is far from trivial. The challenges of handling this complexity are mostly related to the design and testing of the digital components of these chips.

A number of well-researched disciplines must be employed in the efficient design of large and complex chips. These include utilization of several abstraction levels, design of appropriate architectures, several different classes of optimization methods, and development of testing techniques. This thesis contributes mainly to the areas of design optimization and testing methods.

In the area of testing this thesis contributes methods for testing of on-chip links connecting different clock domains. This includes testing for defects that introduce unacceptable delay, lead to excessive crosstalk and cause glitches, which can produce errors. We show how pure digital components can be used to detect such defects and how the tests can be scheduled efficiently.

To manage increasing test complexity, another contribution proposes to raise the abstraction level of fault models from logic level to system level. A set of system level fault models for a NoC-switch is proposed and evaluated to demonstrate their potential.

In the area of design optimization, this thesis focuses primarily on logic optimization. Two contributions for Boolean decomposition are presented. The first one is a fast heuristic algorithm that finds non-disjoint decompositions for Boolean functions. This algorithm operates on a Binary Decision Diagram. The other contribution is a fast algorithm for detecting whether a function is likely to benefit from optimization for architectures with a gate depth of three with an XOR-gate as the third gate.



Linköping University

Linköping Studies in Science and Technology No. 1490, 2012

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