

Preface

For over four decades, the semiconductor industry has experienced exponential growth. According to the *International Technology Roadmap for Semiconductors*, as we advance deeper into the era of nanotechnology, traditional *Complementary Metal Oxide Semiconductor* electronics will soon reach its physical and economical limits. This book deals with the opportunities offered by disruptive technologies and in particular explores novel designs for digital architectures (with an emphasis on reconfigurable structures).

In a first approach, we will base our investigations around conventional FPGA architectures, and examine ways in which disruptive technologies can lead to structural improvements. In a more prospective approach, we will then also present some novel architectural schemes for ultra-fine grain computing, where the inherent properties of the considered disruptive technologies lead to reduced size of the logic elements.

All these improvements are explored in a unified way by a new methodological approach, which allows the fast evaluation of an emerging technology on a prospective architecture. We use this to discuss their impact, from the level of simple circuits to that of complex architectures.

Several technologies, ranging from 3D integration of devices (Phase Change Memories, Monolithic 3D, Vertical NanoWire-based transistors) to dense 2D arrangements (Double-Gate Carbon Nanotubes, Sublithographic Nanowires, Lithographic Crossbar arrangements), have been envisaged. Novel architectural organizations, as well as the associated tools, are presented in order to explore this largely uncharted design space.

This book represents a new step in the field of nanoarchitectures. It makes the link between technology and applications by proposing prospective designs and toolflows adapted to the requirements of both sides. It thus lends precious insight into the field of emerging technologies for designers as well as technologists. Indeed, this book considers disruptive technologies from an architectural perspective, while all technological assumptions are validated. Thus, this book covers a broad range of fields that must be addressed holistically in such prospective research.



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From Device to System Level

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