Nanotechnology and nanoCMOS

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While the progress in nanoCMOS (referring to the top down approach) and nanotechnology (referring to the bottom up approach) continue at an impressive pace, the question remains how nanoCMOS and nanotechnology will mutually benefit from each other.

Besides the fact that reliability of these nanoscale (active and passive) components in a complex system becomes a real bottleneck, there are three main challenges: limiting of power consumption, addressing the loss of predictability introduced by geometry, circumventing lay out as well as process variability, and finding solutions for systems and circuits with non-ideal transistor and wire behavior.

There are several ways in which nanotechnology is already introduced in current nanoCMOS technology. It is clear that a cross-fertilization has taken place by providing almost atomic control for thin functional films both in the transistor technology and in the wiring technology.

However, there is much more to come, as a nanoCMOS/nanotechnology hybrid in a heterogeneous integrated system is a very attractive platform for bringing new functionality in an already gigascale complex system. So far, feasibility of nanotechnology has been investigated with little attention to controlled reproducibility and reliability. In particular, it must be realized that fault tolerance is an issue. Actually, now that the robustness of nanoCMOS has to be questioned and that sensing and controlling circuits may be necessary to cope with these limitations, the initial drawbacks of nanotechnology may be viewed from another perspective.

In the future, the meeting point between nanoCMOS and nanotechnology will not only be characterized by their similar length scales, but by the degree of control (predictability) and fault tolerance which can be dealt with by innovative system design.

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