

TECHNOLOGY COMPUTER-AIDED DESIGN

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In the development of miniaturized devices for integrated circuits, and particularly their technology, the demand for models being capable of predicting the various processing steps of device fabrication on the one hand, and the electrical behavior of devices on the other hand is growing dramatically due to the tight coupling of electrical device effects with the doping profile. These models are implemented as fairly complex software packages since the underlying physics is definitely not trivial. These software packages have served as simulation tools for engineers and researchers. Recent developments have even proven the need for integrating these process and device simulation tools into a common environment to allow centralized simulation control and information exchange. Such an environment is called a Technology Computer-Aided Design (TCAD) framework.

The demands on TCAD range now from simple simulation tool coupling over process and device characterization, to technology optimization. Therefore, a vast variety of tools is required: graphical editors, process, device, and interconnect simulators, parameter extractors, optimizers, postprocessors, etc. Integration of these tools into a homogeneous TCAD environment requires answers to three key questions: a common format for data exchange has to be decided, a powerful shell language for extension and customization has to be chosen, and a graphical and interactive user interface is mandatory.

In this presentation the international state of the art of proposed solutions to TCAD frameworks will be discussed. The efficient integration of existing tools will be explained. The structure of tools to be newly developed to suit the execution best within a TCAD framework will be outlined. The progress expected in TCAD will be estimated.

As a particular example, the minimization of the substrate current of an n-channel MOS transistor through the variation of the dose of the lightly doped drain (LDD) implant will be discussed. For this purpose, process and device simulation tools are coupled within an optimization loop within the TCAD framework VISTA (Viennese Integrated System for TCAD Applications). Some remarks on the computational requirements will be given.