

WCM Panel Questions on SPICE MOSFET Model Standards

Q: As a user of the model are you concerned which MOSFET model to use: surface potential or charge based for sub-100nm nodes?

A: Our primary concern is that the model provide accurate RF/analog/digital simulations, including over statistical process distributions, while being mathematically well-behaved. If either type of model can provide this then we are not concerned about whether it is surface potential or charge based.

Q: How many models do we need - one standard model or more than one?

A: At each node, we only need one model, though the same standard model should be capable of spanning at least a few nodes.

Q: What will be support issues for more than one model and will foundries support it?

A: The overwhelmingly most important issue in supporting more than one model is cost: modeling resources are finite and work on very aggressive schedules. For both its foundry and internal IC design businesses, TI does not support more than one standard model at each node.

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Q: What type of interaction would the design community like from the model developer for a better understanding of the model?

A: Designers want to understand accuracy to help them make design decisions and manage risk. This translates into knowing how well a model has been fit to measured data and/or transistor targets; designers also want to know how mature this information is. These are not areas where the academic model developer is knowledgeable.

At TI, communications about models comes from its modeling engineers, who themselves have expert understanding of the models gained in part through communications with the model developer.

Q: What does it takes for a model to move from academia to industry?

A: A model needs to be productized. Semiconductor and IC companies prefer to spend very little of their own resources on this, so the developer is looked to for productization. The Compact Model Council has provided developers with financial means and a forum for technical guidance.

Q: Do we need a "standard model" or a "model standard"?

A: A "standard model". Financially, the industry is driven towards this...

How to Engage a Diversified Model Developer Community Towards the Same Ultimate Goal?

- The least expensive means of getting SPICE model R&D and productization is by funding universities via consortia (e.g., SRC and CMC):
 - An in-house SPICE model equation R&D staff of five engineers costs approximately \$1M/year. (Unlike some companies, TI does not have dedicated SPICE model R&D staff.)
 - SRC currently spends approximately \$0.9M/year on SPICE model R&D; this cost is shared by its 8+ members.
 - CMC funds SPICE model productization with membership dues of only \$15K/year.
 - TI gets the most of its ROI from the SRC and CMC through very active participation.
 - Is there really a competitive advantage at the product level in having your own model? The SPICE modeling advantage comes from expertise in model extraction.
- To maximize ROI, consortia put pressure on university model development groups to collaborate, since it becomes unfeasible to adequately fund multiple, parallel (competing) research projects.
- One standard SPICE model with multiple contributors is BY FAR the most cost-effective scenario.
 - Verilog-a can be a significant enabler for this because it simplifies model code development and implementation.
- Industry-wide consortia provide a very focused, cost-effective means of steering the model developer community towards the same ultimate goal.