Using Standard Modeling Languages for Compact Modeling

Ali M Niknejad

BSIM Group
Berkeley Wireless Research Center (BWRC)

Standard Compact Modeling Language

- The benefits are clear:
  - New models easily incorporated into simulators
  - Custom modeling easier to do
  - Model development is more academic
  - Allows researchers to focus on device physics and modeling rather than writing "C" code

Lessons from BSIM4

- Standardized by CMC
- Added major new RF functionality:
    - NQS AC Model
    - NQS Noise (Including Gate Induced)
    - Substrate Resistance
    - Accurate Gate Leakage
- BSIM4 hit the scene during the boom in start-ups doing RF ICs
- Yet BSIM3.3 continued to be the most widely adopted model for a long time?

Engineers are good Inductors

- BSIM 3.3 was widely tested and accepted
- Shifting to BSIM4 was perceived as risky
- RF functionality and gate leakage could be added with a sub-circuit around MOS
- Initial bug in EDA implementation of BSIM4 resulted in speed loss

- Lesson: Engineers will only change if the rewards greatly outweigh the risks (even perceived risks)

Standardized Language for Compact Modeling

- To be successful:
  - Models have to be faster than hand-coded models
  - Accuracy cannot be compromised

- Much research is needed to achieve this goal
- But this is a step in the right direction
- "gcc -O3" != "gcc"