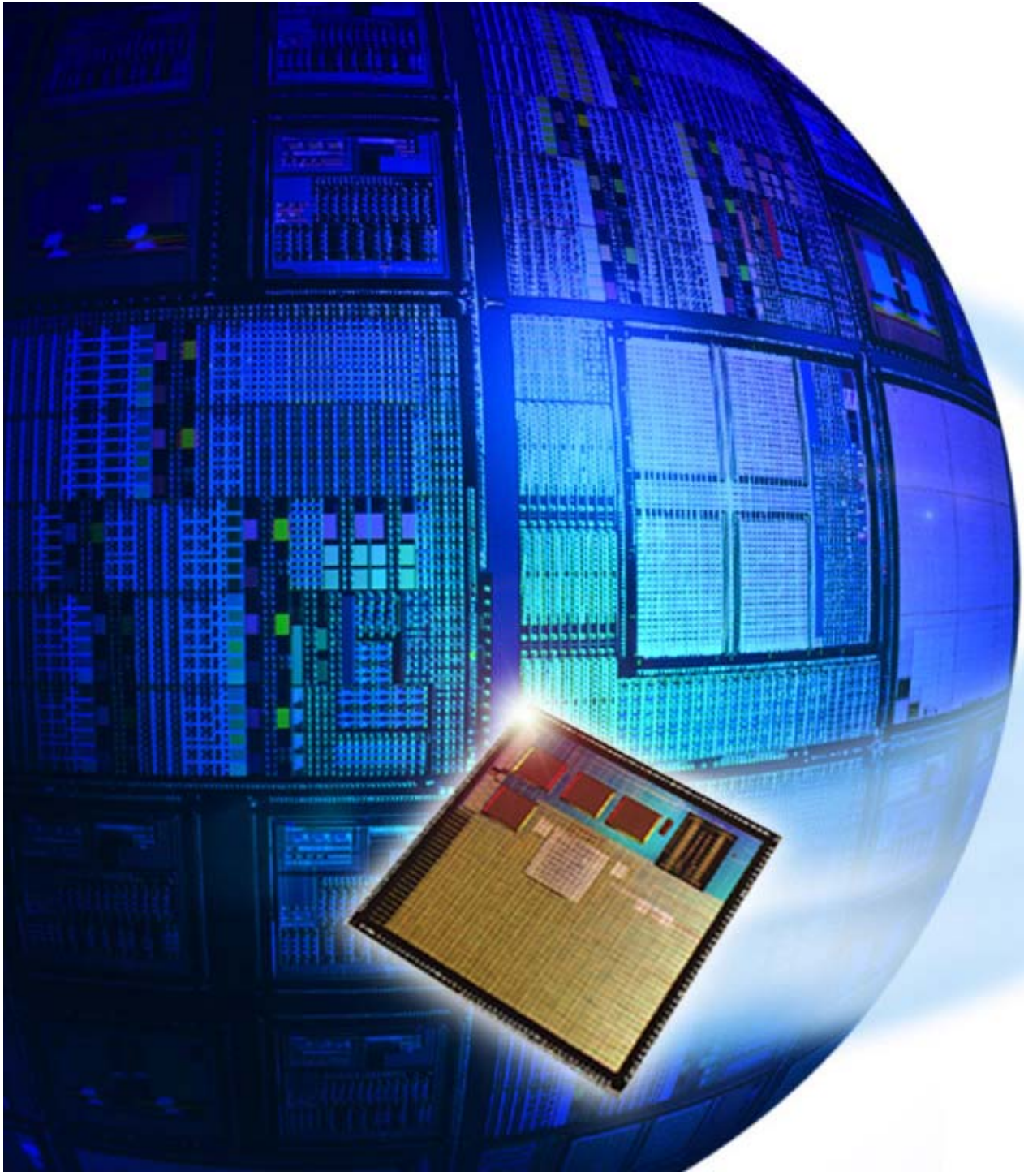

LSI LOGIC®

The Role of Compact Models in the Fab and Fabless Business

Peter Bendix

Key Points

- Accurate Simulation of a variety of digital and analog circuits.
- Predict next generation technologies to aid process development.
- Provide uniform language for communication.
- Generate revenue for researchers, EDA vendors, semiconductor manufacturers, consultants.
- Vehicle for teaching and learning device physics of transistors.
- Knowledge transfer between designers and modeler builders.
- Simplify parameter extraction.

Accurate Simulation

- BSIM3/4 problems
  - Intrinsic mosfet capacitances
  - Symmetry about Vds=0
  - High frequency behavior
  - Noise
- Surface potential based model should address these issues.
  - Vth based models unlikely to be as successful.
  - Even Berkeley now working on surface potential (validation?), but late.

Predict Next Generation

- Number of U.S. fabs shrinking.
  - Model prediction even more important.
  - Experimental data harder to obtain and will take longer coming from foundries.
- Must have as physically based model as possible.
  - Empirical models have proven to be unreliable for prediction.

Uniform Language

- Almost no communication between large EDA vendors.
- Very reluctant to incorporate new models.
  - Mentor and Cadence most helpful.
  - Synopsys and Nassda uncooperative.
- Need easier flow for getting models into simulators.
  - Verilog-A?
  - Need checking for correct implementation and consistency among vendors.

Uniform Lanuage (continued)

- CMC was supposed to provide model checking, but has not been able to keep up.
- Many surface potential based models coming out now.
  - Need unbiased groups to evaluate among these and choose the best.

Generate Revenue

- **Free models is an archaic idea.**
  - **Without financial rewards, there may be no good models developed and supported.**
  - **Model support just as important as model development.**
    - **Includes model implementation, bug fixes, improvements, technical assistance.**

Teaching and Learning

- **Models like EKV and SP could be (and are) excellent teaching models.**
  - **Adding more and more parameters to empirical models is not good for teaching.**
    - **Will turn students off and keep new people from entering modeling.**

Knowledge Transfer

- Mixed signal/analog design puts the most pressure on models.
  - Large communicaton gap between designers and model builders.
- Good compact model could help bridge this gap.
  - Behaves correctly in all regions of operation.
  - Both groups could learn from each other
    - instead of throwing model over the wall and using as a black box.

Simplify Parameter Extraction

- Parameter extraction extremely painful.
  - Parameters too correlated.
  - Impossile to find graduates who want to work in thi field.
    - Those who are in it only last a year or two, usually.
    - Then get bored and leave.
  - Job needs to be made more interesting and fun.
    - Won’t happen with empirical models.