The Berkeley Model Development Environment (MDE)
a tutorial style introduction to the NEEDS-only pre-α release

Tianshi Wang
Aadithya V. Karthik
Jaijeet Roychowdhury

EECS Department
University of California at Berkeley
NEEDS-SPICE and its Goals

- **Question**: How does <your favourite device> perform in a circuit/system?

- Model → Simulate → Build

- NEEDS-SPICE (incl. MDE)
  - quickly develop compact model
  - easy for device physicists
    - using MATLAB/Octave
  - general – not just “EE devices”
  - open and standardized
    - enable open-source and proprietary simulators to access “simulation-ready” models

nano-device examples

spin-torque devices

nanotube/wire transistors

ambipolar FET

organic transistor

MUGFET

nanowire memristor
needs SPICE Model Development Flow

- Analytical Equations for Device
- Write ModSpec Model (in MATLAB)
- Test immediately (standalone)
- Run Small Circuits in MDE (Model Development Environment)

- Takes hours or days

- DC/AC/TRAN in MATLAB

- Go to next step in flow

- Satisfactory ModSpec model

- Results OK?
  - Yes
  - No

- Check/fix coding easier/faster in MATLAB

- Add/tweak init/limiting functions

- Debug/improve robust convergence?
  - No
  - Yes

- Code available for inspection and debugging

- Go to next step in flow