

## Tutorial 6: Tools for Device Modeling: From SPICE to Scientific Machine Learning

Keno Fischer, JuliaHub, Inc.



### Abstract:

How do we know if our devices will work before we tape them out? Since the dawn of the semiconductor industry, modeling and simulation has been a cornerstone of both process development and pre-tapeout verification. And yet, despite this rich heritage, some of the most impactful capabilities remain underutilized or locked away in hard-to-use, bespoke tools.

In this tutorial, we will take a look at the modeling modalities available for semiconductor devices, from our venerable compact MOSFET models, through TCAD, down to direct Density Functional Theory calculations. We will explore how we can leverage these models beyond simple simulation for device optimization, characterization, model calibration and more. Then, we will turn to more recent techniques, exploring how Scientific Machine Learning allows the creation of multi-scale surrogate models at tunable fidelity and performance. Finally, we will look at our real-world experiences developing CedarEDA and vision for the future of device modeling and how we can bring advanced modeling closer to engineering practice to reduce the costly iterations, build better devices, and improve our engineering productivity.

### Bio:

Keno Fischer works as Co-Founder/CTO at JuliaHub, Inc., where he leads the development of the CedarEDA suite of EDA tools. For the past 10 years, Keno's highly interdisciplinary research has focused on bringing the latest advances in compiler technology, programming language design, machine learning and computational science to everyday engineering practice.