

Validation of Physics-Based Modeling for High Speed Communication on PCBs

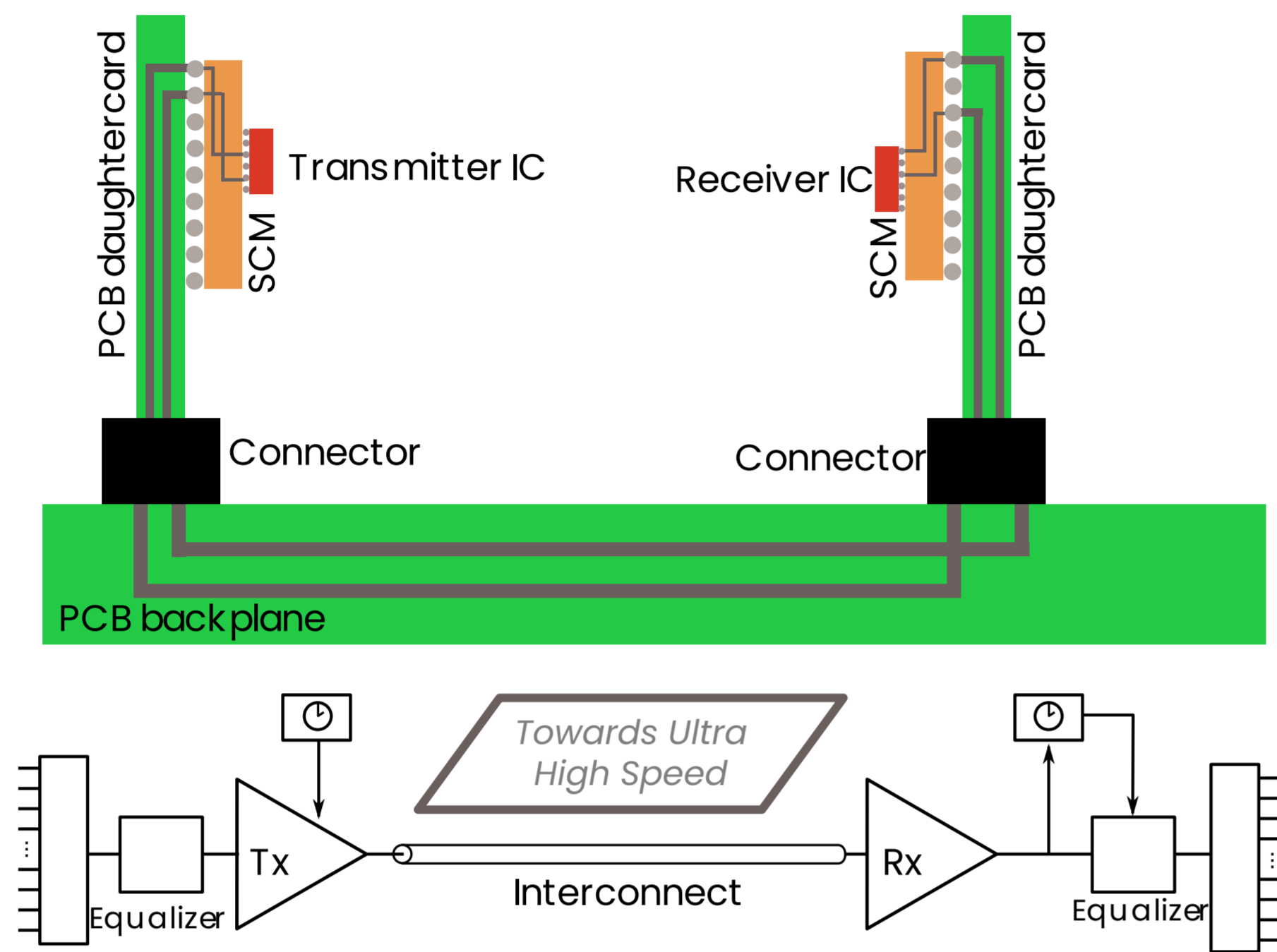
Til Hillebrecht, M. Sc.

Motivation

Why do we use physics-based approaches?

In today's world the required data widths continue to increase and such bring higher frequencies. Simulations as well as machine learning approaches are an integral part of the PCB design process, and those need even more data and faster simulations. For the generation of vast datasets it is highly beneficial to have accurate and fast simulation tools.

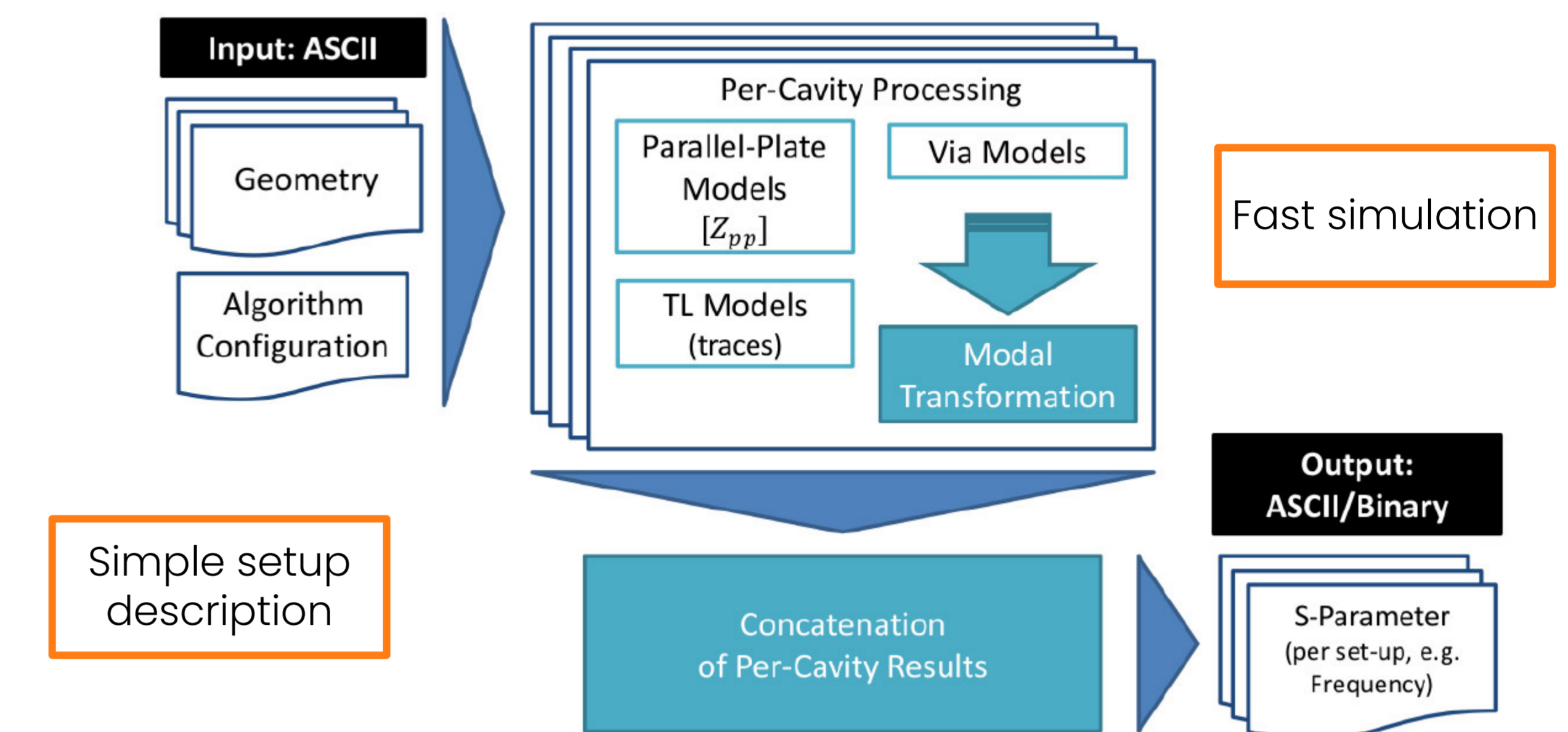
- 100+ Gbps
- Simulations
- Large Databases
- Machine Learning
- Efficient Design Process



CONMLS

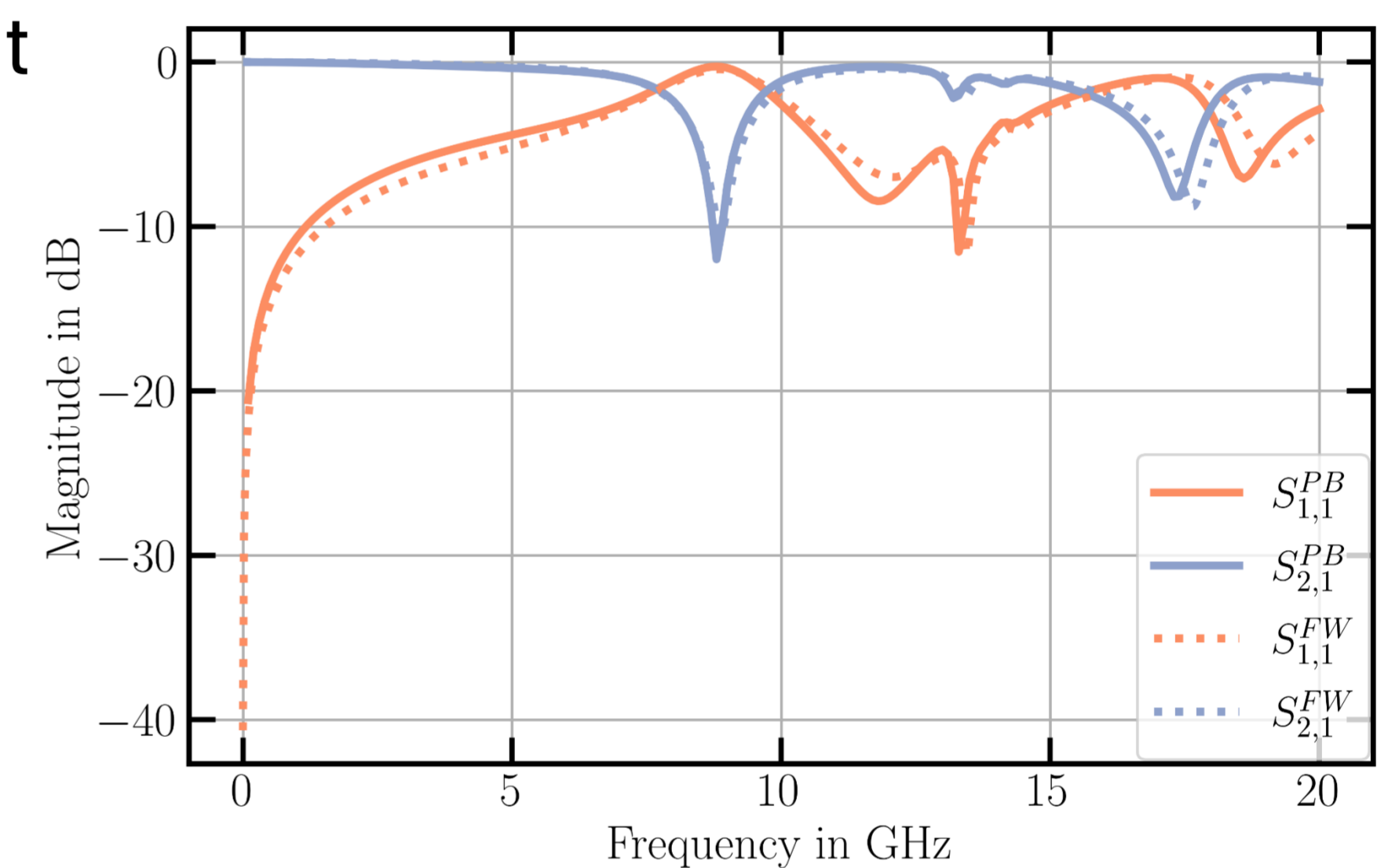
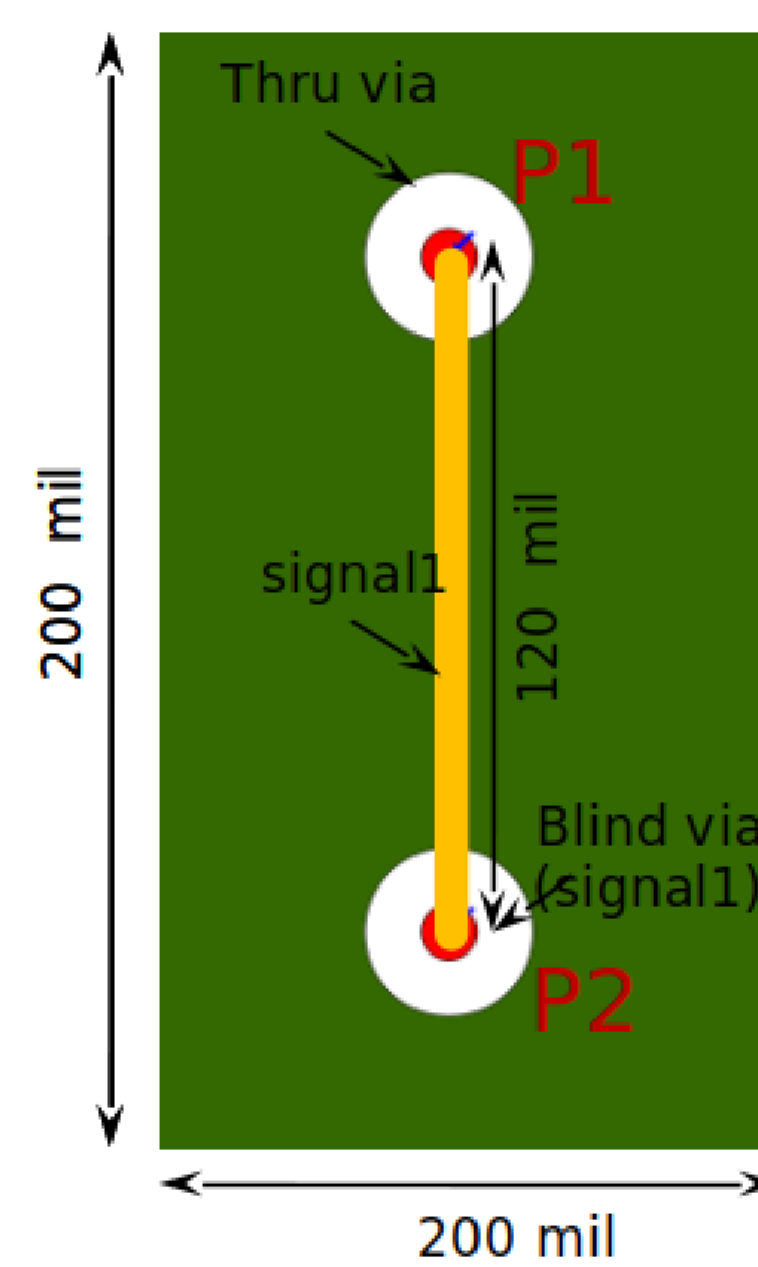
How does the software work?

This Multilayer Substrate Simulator implements the aforementioned physics based models in Fortran. It is easy to use and provides results quickly. [2]



Simulation Result

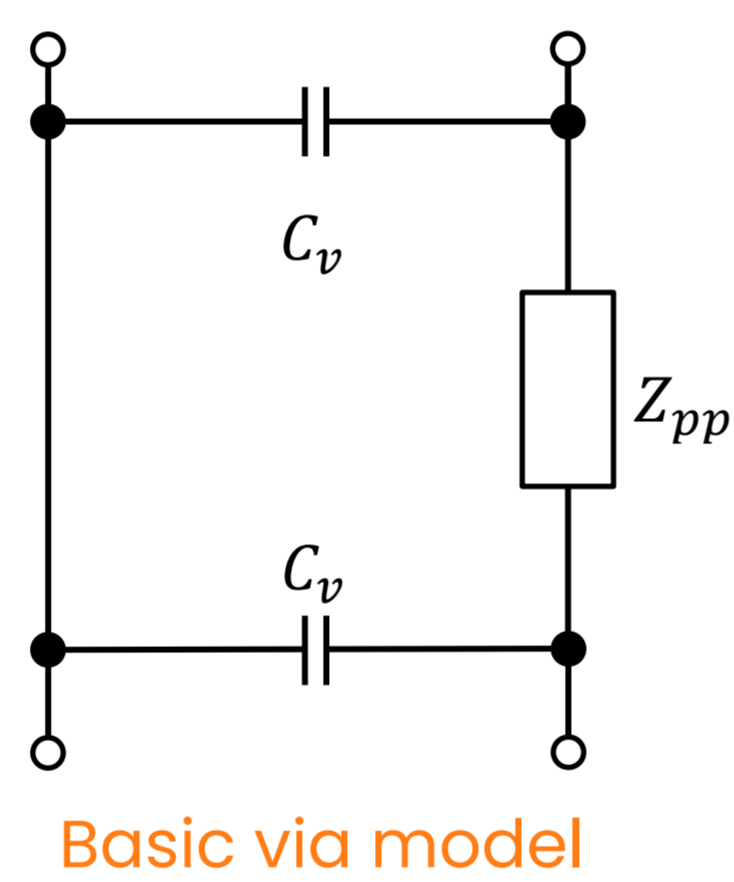
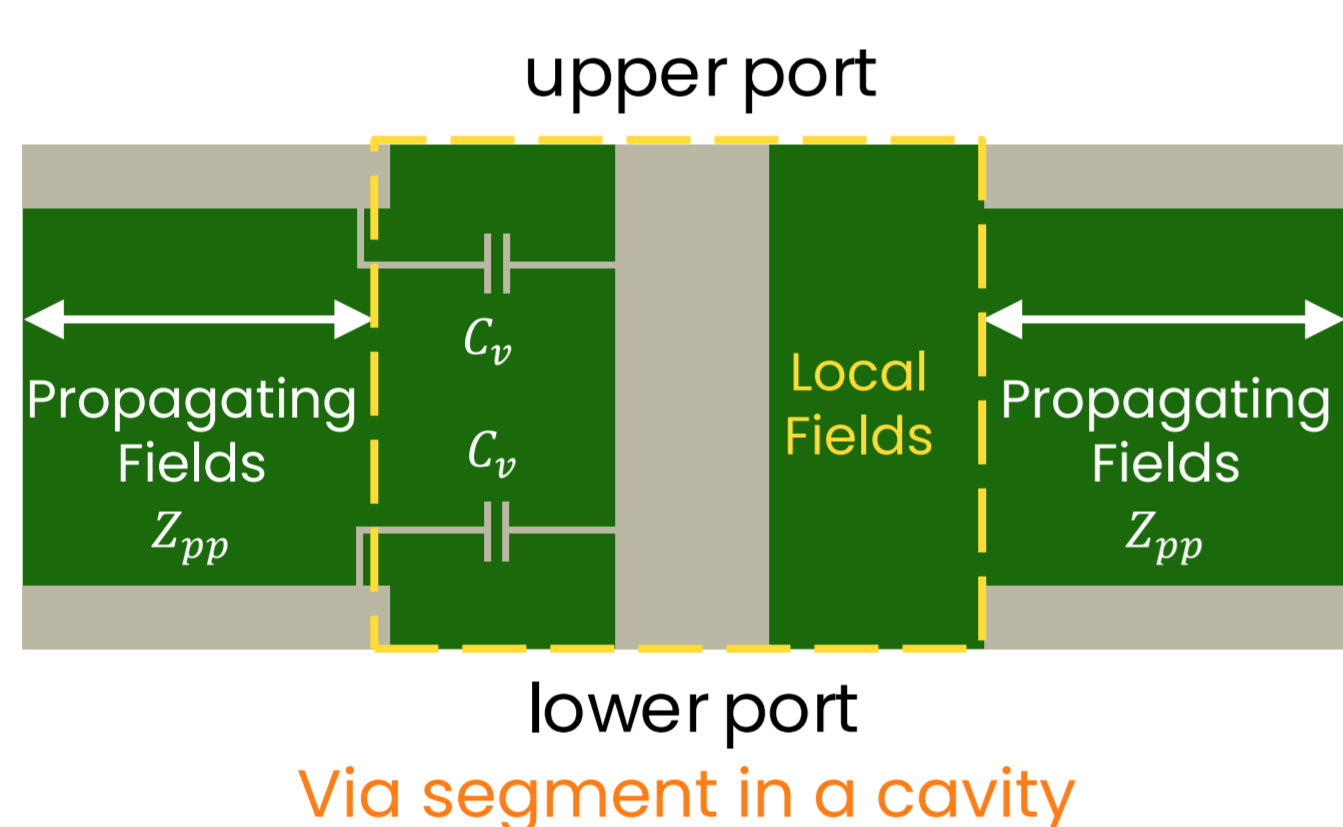
A simple example



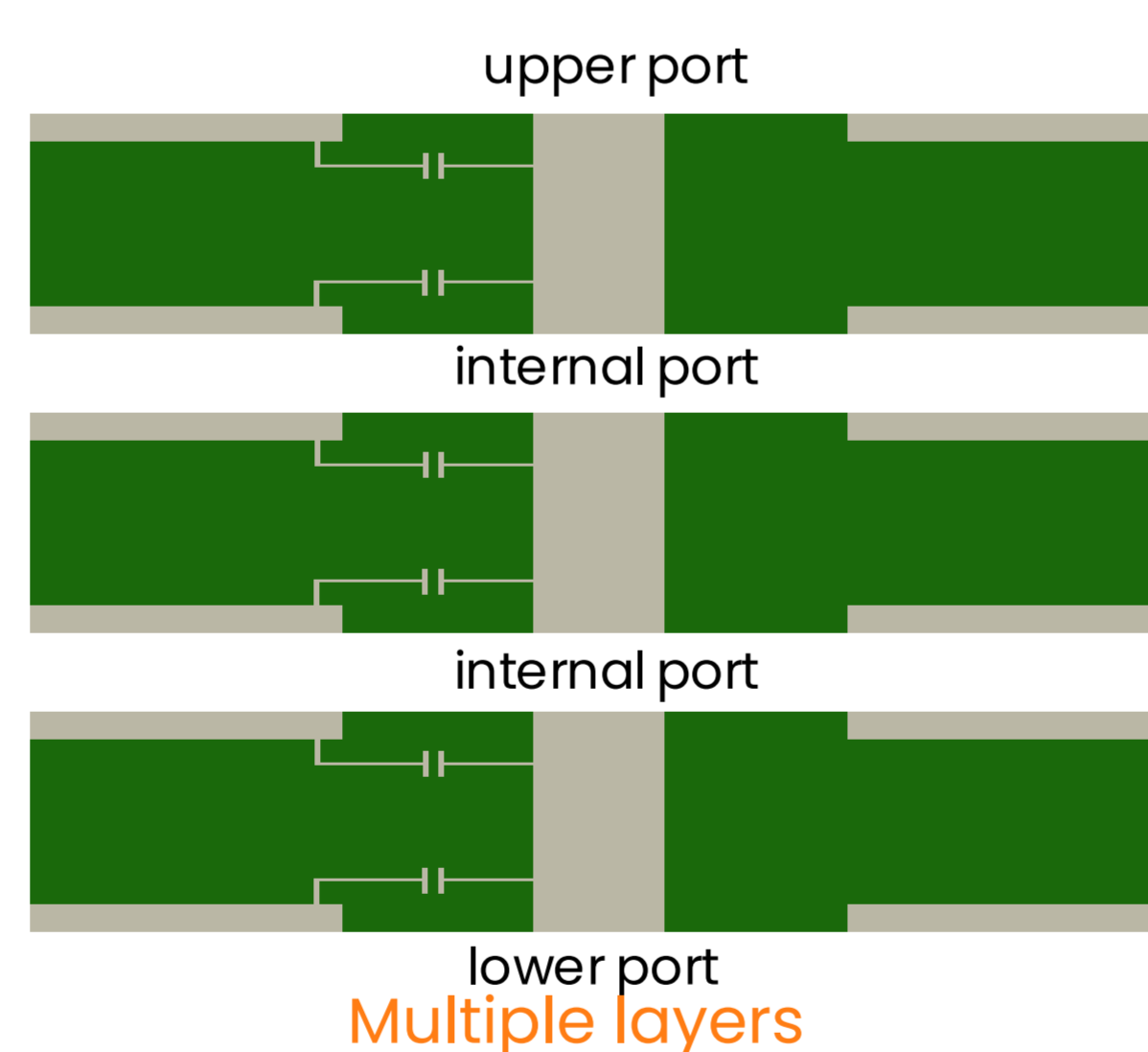
Validation has been carried out up to 40 GHz in the past [3]. For Ultra High Speed Interconnects frequencies up to 100 GHz need to be considered.

Physics Based Models

How to describe the phenomena?

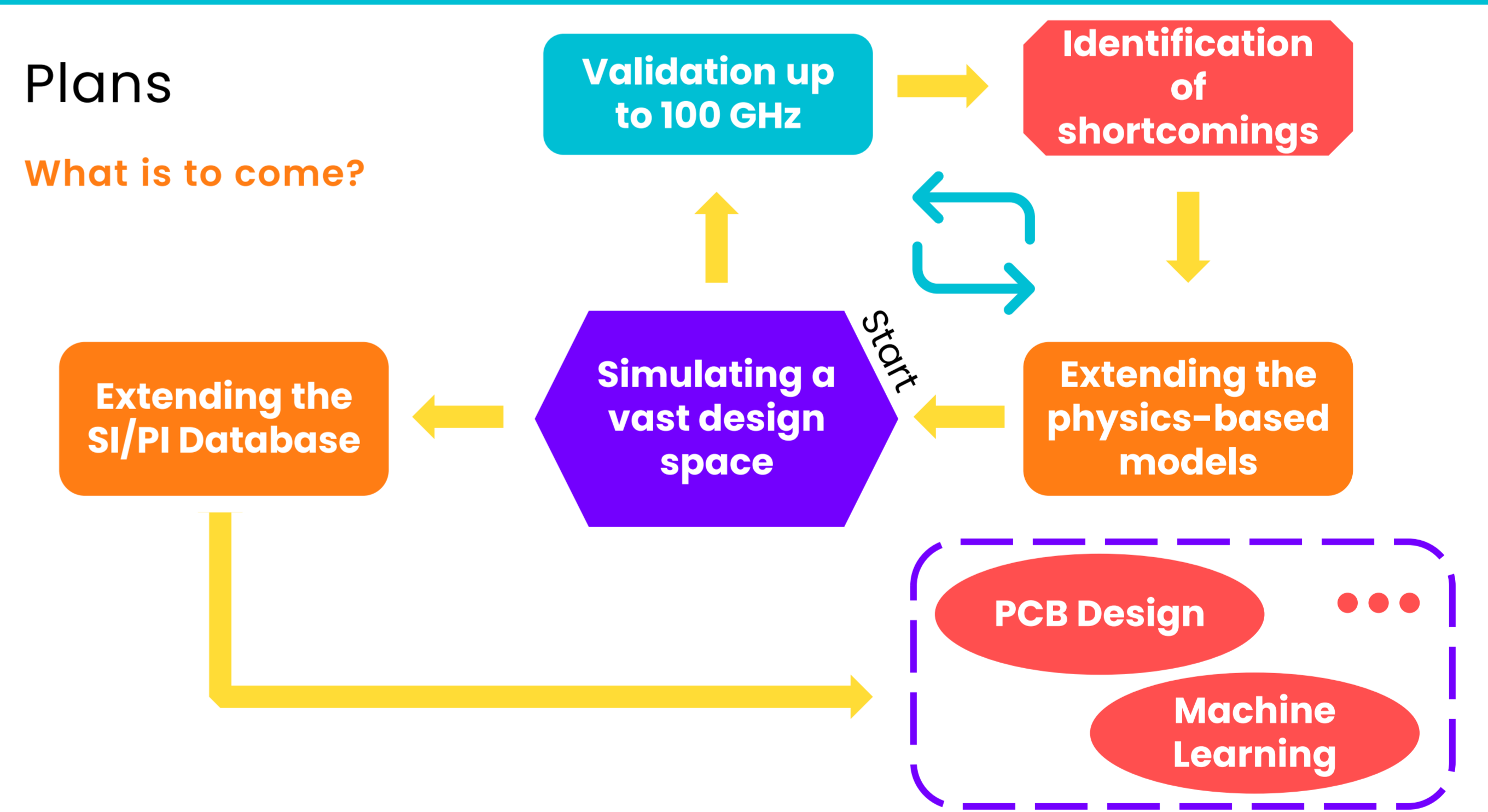


Vias in PCBs are represented by parallel plate impedances Z_{pp} propagating between the metal plates in a cavity and by local fields in the antipad region of the via, which are modeled by capacitances. The vias are excited by coaxial waveguide modes, which are converted to radial waveguide modes near the vias. Each cavity is simulated individually. First die local and propagating fields are combined, then all the cavities are combined using segmentation techniques. [1]



Plans

What is to come?



References

- [1] S. Müller, F. Happ, X. Duan, R. Rimolo-Donadio, H.-D. Bruns, and C. Schuster, "Complete modeling of large via constellations in multilayer printed circuit boards," IEEE Transactions on Components, Packaging and Manufacturing Technology, vol. 3, pp. 489-499, mar 2013,
- [2] David Dahl SebastianMüller, Torsten Reuschel / Rimolo-Donadio, Renato CONMLS 2017 Institut für Theoretische Elektrotechnik, Hamburg University of Technology (TUHH), Institut für Theoretische Elektrotechnik, Hamburg University of Technology (TUHH),
- [3] R. Rimolo-Donadio, Development, validation, and application of semi-analytical interconnect models for efficient simulation of multilayer substrates. Logos Verlag Berlin GmbH, 2011.

Where to find more information?