KOLLOQUIUM

Surrogate Models in Diagnosis, Tuning and CAD of Microwave Filters and Multiplexers

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Accurate synthesis techniques for microwave circuits are only possible for a small variety of structures. In general, the more complex a circuit structure becomes the less likely it is that the synthesized values can be directly translated into geometries to match the specified response. A possible alternative appears to be the use of electromagnetics (EM)-based analysis in combination with an optimization routine. However, depending on the complexity of the circuit structure, and considering that for each optimization step the circuit must be analyzed several times, (directly equivalent to the number of geometrical filter elements), the use of general EM-simulators for the optimization can become a very time consuming if not impossible task. This is in particular true for the widely used domain methods like the Finite Element Method (FEM) or the Finite Difference Time Domain (FDTD) method. Here not only run-time problems occur but also the simulation accuracy may suffer due to the re-meshing of the structure after each geometry change.

To alleviate this problem, the use of surrogate models in conjunction with EM solvers has shown significant potential. This will be illustrated for the case of microwave filters and multiplexers. By combining a generic coupling matrix description of the filter model -easily adaptable to complex filter structures- with a general (commercial) field solver, the actual filter optimization is performed via the generic model while the EM solver is used only to update the model. Results will be shown for automatic production tuning of waveguide filters and for the design of planar filters and multiplexers.