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EEI KOLLOQUIUM

Designing Broadband Microwave Devices using Density-based Topology Optimization

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Diskussionsleitung: Prof. Dr.-Ing. R. Weigel

Computational design optimization is based on the idea of exploiting the power of computer simulations and numerical optimization algorithms in the engineering design process. A particularly powerful technique is known as density-based topology optimization, in which the geometry of candidate designs is represented as thousands up to millions of pixels (2D) or voxels (3D). This approach leads to very large-scale optimization problems that nevertheless can be solved efficiently using gradient-based optimization algorithms if the gradients are computed using the so-called adjoint-variable technique. A main advantage with this methodology is that the conceptual layout of the design is not fixed a priori but will emerge from the computations. This method was originally developed for the design of load-carrying elastic structures and is commonly used for the design of advanced mechanical components, particularly in the auto and airline industries. We have successfully adapted and developed this approach for the problem of designing radiating metallic structures in the microwave regime. Using our method, we have designed conceptually new wideband patch antennas for sensing and communication, coaxial-cable-to-waveguide transitions, implant antennas, and probes for medical applications.