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Talk announcement

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Sensitivity-Based Topology and Shape Optimization for Electrical Machines subject to Nonlinear Magnetostatics

In industry, it is desirable to design electrical equipment such as electric motors in such a way that they are optimal with respect to some given criteria like, e.g., energy efficiency or having little noise and vibration. Therefore, decisions on the layout of such machines are more and more made relying on computational design optimization tools.

We consider the design optimization of an electric motor subject to the equations of two-dimensional nonlinear magnetostatics. We derive the formulas for both the shape derivative and the topological derivative of this nonlinear problem and present numerical results obtained by algorithms that are based on these kinds of sensitivity information.

In the course of the numerical optimization process, the interface between different materials (e.g., ferromagnetic material and air regions) is evolving and is, in general, not resolved by the finite element discretization. We present a local mesh adaptation strategy that is able to accurately resolve the interface and show that it assures the optimal order of convergence independent of the location of the interface relative to the mesh.