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A parametrised mesh generator for finite element sensitivity computation

This paper presents a new parametrised mesh generator for sensitivity computation in finite element optimization. The generator allows repeated solutions with iterated meshes so that it can be employed in a first order optimization strategy exploiting its faster convergence rates.

It has been shown that of the various methods of optimization, gradients based methods are powerful. But in engineering design with finite element meshes, there are mesh-induced object function discontinuities that are seen as local minima and the optimization process fail.

A structural mapping method has been proposed in the past to overcome this problem but it requires a two-part solution, an artificial structural problem and then a real problem in the domain of the field, in our case the electromagnetic field as in designing electrical devices.

We detail a novel parametrically defined mesh that produces elastically deformed meshes preserving object function continuity and derivative continuity. The several types of the necessary parametric definitions are detailed to have a suite of algorithms that can handle any kind of optimization geometry.