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# Solving Large Scale Imaging Problems Using Manifold-Mapping Combined With Adjoint Sensitivity

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Measuring the electro-magnetic field caused by different current paths in a work piece allows for a non-invasive imaging of corrosion spots. Solving this inverse problem on an industrial scale by a black box still represents several computational challenges. We formulate the problem as a PDE-constrained optimization in which one aims at minimizing the discrepancy between measured and simulated data in an appropriate norm. The straightforward inclusion of a finite element procedure in a derivative-free optimization is prohibitively expensive. The space-mapping technique is a family of surrogate-based optimization methods that aim at alleviating this bottleneck. The manifold-mapping technique in particular is an output space-mapping technique in which the mapping between the fine and coarse model is constructed in such a way to guarantee the converge the convergence to a (local) minimizer of the fine model. In this work we attempt to combine the manifold-mapping algorithm with adjoint sensitivity hoping to combine the best of both worlds. We envisage to arrive that an hybrid algorithm that is faster to convergence (due to the inclusion of gradient information) while at the same being able to escape from local minimizers (inclusion of coarse model information). Preliminary numerical results will illustrate some of the salient points discussed.