An idea to couple a BEM and a grid-based method for EIT via an evolutionary algorithm

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In a number of applications of impedance tomography - like, for example, in the case of the human thorax - the conductivity has the property to be of high contrast and to present only a few inhomogeneties. In such a situation it seems natural to approximate the conductivity by a piecewise constant function and to treat the inverse EIT problem via a boundary element method (BEM). Compared to the mostly used grid-based methods this reduces the spatial dimension of the problem by one and can deal with a variable size of the inclusions. However these methods need the a-priori information of the number and approximate location of all inclusions which is often not available. For this case we suggest to combine them with a grid-based method which is used to provide an initial guess for the BEM. As grid-based method we try an iterative FEM method as well as the factorization method by Brühl and Hanke, and the BEM we employ is an extension of an integral equation method proposed by Kress and Rundell. The coupling of the methods is done via an evolutionary algorithm which additionally is used to determine the regularization parameters for the integral equation method.