

# **A Preconditioned MINRES Method for the Coupling of Mixed-FEM and BEM for Some Nonlinear Problems**

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## **Abstract**

We provide an efficient solution procedure for the linearized Galerkin schemes arising from the combined use of mixed finite elements (mixed-FEM) and boundary elements (BEM) to solve a class of nonlinear problems. As a model, we consider a nonlinear-linear transmission problem appearing in electromagnetism and steady heat conduction. Since the corresponding continuous and discrete variational formulations become nonlinear twofold saddle point problems (also called dual-dual formulations), we propose to apply Newton's method to the Galerkin schemes, thus yielding linear systems with the same dual-dual structure. Hence, we follow previous works on this kind of operator equation and derive a preconditioned minimum residual (MINRES) method that guarantees a bounded number of iterations (independent of the mesh size) to solve these systems.