OPERATOR PRECONDITIONING FOR TWO-DIMENSIONAL SCREEN AND FRACTURE PROBLEMS USING BOUNDARY ELEMENTS

CARLOS JEREZ-HANCKES AND CAROLINA A. URZÚA TORRES

Abstract. Operator preconditioning [1, 2] based on Calderón identities breaks down when considering open boundaries as when modeling screens or cracks. On the one hand, the double layer operator and its adjoint disappear. On the other hand, the associated weakly singular and hypersingular operators no longer map fractional Sobolev spaces in a dual fashion but degenerate into different subspaces depending on their extensibility by zero.

Based on Calderón-type identities deduced from Jerez-Hanckes and Nédélec [3, 4] for an open interval, novel preconditioners can be established for associated integral operators. In this presentation, we show the numerical implementation of these preconditioners for the Laplacian, as well as an extension to the Helmholtz operators and other interesting formulations. Furthermore we discuss two solution methods obtained by these Calderón-type identities and some future extensions.

Keywords: Open surface problems, integral logarithmic equations, boundary integral equations, Laplace equation, Calderon projectors

Mathematics Subject Classifications (2000): 45P05, 65N38, 31A10, 46E35

References