NUMERICAL ANALYSIS OF THE BOUNDARY INTEGRAL METHOD

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One of the important recent developments in numerical engineering has been the boundary integral method (bim)([5], [6], [10], [18]). This technique is useful because the most common practical problems can sensibly be expressed as linear equations in a homogeneous medium, and the full generality of the finite element method is not needed. In these "simple" situations the bim is a valuable means of using the special structure of a problem to save computational effort. Additionally the scope of the bim is currently being extended to include some non-linear, time dependent and non-homogeneous problems ([6], [18]).

A parallel effort has also been made to give a theoretical basis for the bim. Two of the important early papers were Nedelec and Planchard [14] and Hsiao and Wendland [9]. The difficulty is the appearance of first kind integral equations. The classical boundary integral equations (bie's) described in [12] or [13] reformulate potential problems as second kind integral equations. The numerical solution of these equations is understood ([1], [3], [4], [11], [16]), and is well described by the most elementary functional analysis. To deal with first kind equations more theory is required, and fractional order Sobolev spaces are introduced to describe the boundary values of the solution to the underlying differential equation.

Because of their importance the fractional order spaces have been developed in great generality ([15]). However for the analysis of numerical solutions to bie's most of this is unnecessary, and references to the literature can give a false impression of the difficulty of the pre-