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DISPLACEMENT-TRACTION BOUNDARY VALUE PROBLEMS FOR ELASTIC PLATES WITH TRANSVERSE SHEAR DEFORMATION

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ABSTRACT. The existence, uniqueness and continuous dependence on the data are studied in a Sobolev space setting for the solutions of boundary integral equations arising in the interior and exterior mixed boundary value problems for bending of thin elastic plates.

1. Introduction. Applied mathematicians and engineers find closed-form solutions to continuum mechanics problems very convenient, since they facilitate the computation of highly accurate results. The boundary integral equation (BIE) method offers one of the best and most elegant ways of generating such solutions. For the Dirichlet, Neumann and Robin boundary value problems (BVPs) it is possible to construct classical (regular) solutions if the boundary and data are sufficiently smooth. Unfortunately, this cannot be done satisfactorily for mixed BVPs, where the data are usually discontinuous at the points separating the displacement and traction boundary conditions. In this case the net has to be cast wider in order to look for weak solutions to the corresponding BIEs. This technique has two additional advantages: it is also applicable to less smooth boundaries and data, and helps to estimate the convergence rate in boundary element methods associated with the problem, since error bounds are defined quite naturally by means of Sobolev space norms. Weak solution procedures are now familiar to practitioners, who exploit their generality and usefulness extensively.

Mixed BVPs for bending of elastic plates occur very frequently in the modeling of industrial processes, for example, in aerospace engineering, ship and marine technology, and car manufacture. Today's computational power and design sophistication, on a general background of a multitude of environmental issues (such as conservation of natural resources), require more accurate plate bending models than Kirchhoff's classical one. The latter, which reduces to solving a nonhomogeneous biharmonic equation with two boundary conditions, ignores the effects