CHAPTER I

INTRODUCTION

Background

Circular and annular plate structures with mixed boundary conditions have been studied by several investigators using different approaches. Leissa and Clausen [1] gave numerical solutions to the bending of a uniformly loaded circular plate with mixed boundary conditions using the point matching technique to determine the unknown coefficients in a series solution, while Conway and Farnham [2] solved these problems by adding edge moments or shearing forces to adjust a selected solution to satisfy the prescribed boundary condition. Stahl and Keer [3] and Sriswasdi [4] treated the cases of uniformly loaded circular and annular plates of mixed boundary conditions in the form of a Fredholm integral equation.

The application of boundary element method to the problem of plates was proposed by Jaswon and Maiti [5] who formulated the problems in terms of singular integral equations and solved numerically for the case of uniformly loaded rectangular plates with simply supported and clamped edge. Later, Maiti and Chakrabarty [6] and Altiero and Sikarskie [7] treated the problems of uniformly loaded polygonal plates with simply supported edges and fixed supported plates of arbitrary plan forms. Thereafter, Wu and Altiero [8]

suggested the formulation which has been extended to include arbitrary boundary conditions and applied to two rectangular plates with mixed boundary conditions.

The direct method of boundary integral formulation using strain energy theorems have been published by Stern [9] and Tottenham [10]. The latter author suggested to directly formulate the integral equations by Betti's reciprocal theorem and also concluded that singular functions which are involved in the integral equations may be treated by the consideration of force equilibrium. Bezine [11] applied the boundary integral equations to the rectangular plates with interior column supports. These problems have been treated again by Paris and Leon [12] and extended to relate between rectilinear and curved boundary for evaluating a uniformly loaded circular clamped plate with central free hole.

Scope of Study

In this study a general treatment of the direct boundary element method for solving circular and annular plates with arbitrary combination of boundary conditions and interior column supports is studied. Uniformly distributed load and arbitrary concentrated loads may be applied. Numerical results of several plates of different boundary conditions are presented and compared with those by other investigators.

Computer program developed in FORTRAN 77 language is also included for practical used of this research.