CHAPTER I

INTRODUCTION

To analyse problems in plate structures, knowledge in the field of partial differential equation is usually employed. Analytical solution of the problem may not be obtained in case of very complicated boundary conditions. Therefore, numerical methods such as finite differences or finite elements are applied. Mostly of plate structural analysis use finite element method which is developed in advance; but there is another approach named boundary integral method which is of comparable accuracy to the finite element method.

When applying the boundary integral technique to the plate problem, only the boundaries of plate are discretized but when applying the finite element method, the whole area of plate has to be subdivided. As a result of this advantage,not only the dimensionality of the problem can be reduced by one but also a smaller system of simultaneous equations is generated.

However, due to the disrepute of the boundary integral method, the results of boundary integral method have to be investigated with those of finite element method.

1.1 Background

The first application of the boundary integral technique to plate bending problems appears to be due to Jaswon and Maiti (1) who formulated the problems in terms of singular integral equations for uniformly loaded rectangular plates with either clamped or simply

supported edges and solved them numerically around the boundary by digital computer programs. Proceeding along this line, Maiti and Chakrabarty (2) pay attention to the simply supported polygonal plates subjected to uniformly distributed loads to handle discontinuous boundaries especially at the plate corners. Since then, the boundary integral method is progressively developed to cover more types of problems by Altiero and Sikarskie (3), Wu and Altiero (4) and Stern (5).

Applying Betti's reciprocal theorem based on energy considerations, Tottenham (6) formulated equations without involving complicated mathematical formulation. Paper presented by Bezine (7) introduced the boundary integral method to solve plates with various boundary conditions and four interior point supports. The approach is that the usual boundary equations have to be supplemented by an additional condition for each support.

Lastly Yuthana Laokeaw (8) extended Bezine's work by applying the direct method of boundary integral equation to the free-edge rectilinear flate plate with arbitrary interior point supports which axial and rotational stiffness are included.

1.2 Scope of Study

The object of this present study is to extend Yuthana's work by adding interior straight line supports to the bending problem of rectilinear thin isotropic elastic plates with free boundaries. Support of plate can be a combination or alternation of line and point supports within the plate domain. The axial and rotational stiffness of line supports are uniform through each line support. These stiffnesses are provided to facilitate the analysis and design. The original computer program written in FORTRAN 77 has been

adapted for practical uses of this study.

Numerical results carried out on examples are presented and compared with the solution of other investigators and with the finite element solution. The efficiency of the solutions are also discussed.