

SIMPLIFIED METHOD FOR PLATE DEFLECTION CALCULATION

Mohammed S. Al-Ansari

Assistant Professor, Department of Civil Engineering
University of Qatar, Doha, Qatar.

ABSTRACT

This paper presents a simplified method for the calculation of thin-plate deflections. The method, which deals with uniformly loaded plates, uses the stiffness method to obtain plate deflection equations for specified boundary conditions. A case study was presented in order to demonstrate the use of the proposed method and to illustrate its capabilities. The results obtained were in close agreement with those obtained analytically and with those obtained using the finite element methods. Finally, a user-friendly program for plate deflection calculations based on the proposed method was developed using the mathematical package MATHCAD.

Keywords: Plate, Deflection, Stiffness, MATHCAD

INTRODUCTION

A flat plate is a structural element whose thickness is relatively small compared to its in-plane dimensions. A number of analytical methods, such as the equilibrium and energy methods, have been developed for the calculation of plate deflections. However, these methods are not always possible and one must resort to numerical methods such as the finite difference and the finite-element methods.

The finite difference method requires the solution of a set of simultaneous equations while the finite element method requires a mesh generation and a solution for a large stiffness matrix. Even though they are accurate and widely used, these numerical methods are costly since they require longer solution time and can only be implemented by qualified technical people. The high cost of these numerical solutions is not always justified especially in preliminary design cases where low accuracy results are still acceptable. For these cases, a less costly simplified method is usually more than adequate.