

**MECHATRONICS BOOK SERIES
SELECTED PAPERS FROM
ICOM'01, ICOM'05 AND ICOM'08**

Editors

Asan G. A. Muthalif

Amir A. Shafie

Momoh J.E. Salami

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FREE VIBRATION OF VARIABLE THICKNESS PLATES USING CHARACTERISTIC ORTHOGONAL POLYNOMIAL STRIP FUNCTIONS SUBJECTED TO DIFFERENT COMBINATIONS OF BOUNDARY CONDITIONS

Abd El-Fattah A. Rizk*, Ahmed S. Ashour*

Department of Science in Engineering, Faculty of Engineering, International Islamic University Malaysia, 53100 Kuala Lumpur, Malaysia

Email: abdelfattah@iiu.edu.my, ashour@iiu.edu.my

*On leave from Faculty of Engineering, Alexandria University, Alexandria, Egypt.
Corresponding Author

ABSTRACT

A set of characteristic orthogonal polynomial strip functions is used to study the flexural vibration of variable thickness plates in one direction. The starting function in the set, which is satisfying the geometry and natural conditions, is developed from the solution of a static beam subjected to an arbitrary load that expanded into Taylor series. The Gram-Schmidt orthogonalization process is used to generate the remainder functions of the set. The natural frequencies of the plate are calculated by using the finite strip method together with the transition matrix. Numerical results are obtained for different combination of boundary conditions, tapered ratio and aspect ratio. It is demonstrated that this method as well as the orthogonal strip functions yield good accuracy and fast convergence when compared with the available results in the literature. This technique can also be used to solve some other complicating problems in the engineering applications.

1. INTRODUCTION:

Plates of variable thickness are commonly used in many engineering applications such as aerospace, civil, and ocean engineering systems. The natural frequencies and mode shapes of the plate are useful in their operation environments. In the literature, there are many publications concerning the flexural vibration of uniform and non-uniform plates, see for examples Lissisa [1-5]. In the last decades, many of the researchers are used different admissible functions to obtain the natural frequencies of the rectangular and skew plates of variable thickness. Ashour [6] used the eigen functions derived from the solution of a classical beam vibration as basis functions. Cheung and Zhou [7] used a set of admissible functions that are developed from static solution of beam under arbitrary Taylor series load in Rayleigh-Ritz method. Zhou [8] used a combination of sine series and polynomials as the basis functions in Rayleigh-Ritz method. Grossi and Bhat [9] used boundary characteristic orthogonal polynomials in Rayleigh-Ritz method and applied Rayleigh-Schmidt method in their