



GUIDELINE FOR APPLICATIONS OF FINITE ELEMENT METHOD IN STRUCTURAL ENGINEERING

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Abstract: In the modern society, construction industry has to analyse very complicated structures. Therefore structural engineers preferred to use finite element software than analytical methods for their analysis, because analytical methods are very time consuming and even impossible for their analysis. Many finite element software are based on the displacement based finite element method. As it is an approximate method, many drawbacks have been identified in applications in structural engineering due to misconceptions of users. Therefore, the objective of this study is to identify the limitations of using different finite elements to model structural components in buildings such as trusses, beams, slabs, foundations and their connections. To achieve the above objective, several case studies are selected and analysed using SAP2000 software. Based on the above study suitable guidelines have been proposed to the structural engineers for structural modelling.

Keywords: Displacement based finite element method, Guideline, Structural Engineering

1. INTRODUCTION

Displacement based finite element method can present as a three step procedure as given in Figure 1. In the first step, a displacement polynomial function is assumed based on the independent degrees of freedom in an element. Hence, strain function can be obtained by using compatibility relationships. In the second step, stresses can be obtained by using constitutive law. In the final step of the procedure, the element stiffness matrix can be found by applying principle of virtual displacement.

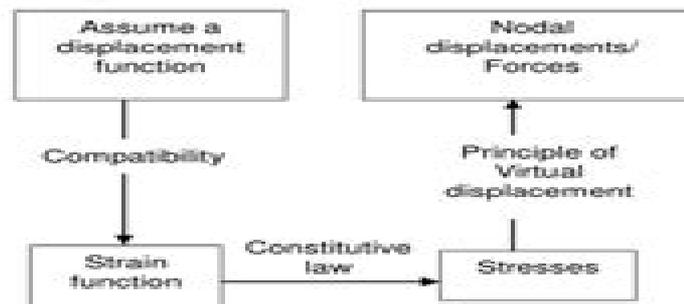


Figure 1: Main steps in DBFE procedure

Problems and limitations of finite element formulation of different elements had been identified when assuming the displacement and when obtaining the stiffness matrix. Problems can be occurred due to the assumption of wrong displacement function and use of numerical integration to obtain stiffness matrix. According to the scope, any complicated structure can be analysed using bar elements, frame

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