Abstract

Structural analysis is one of the essential steps in solving the engineering problems. Several methods are developed to consider the non-linear behavior in the structural response. Improved applied Element Method (IAEM), presented here, is one of the numerical discrete element methods, capable to analysis the structures in the realm of linear, material and geometrical nonlinear and collapse of structures under static and dynamic loading. In IAEM the structure is modeled by cube elements and the degrees of freedom contains two transitional and one rotational, is defines in the center of the elements. In this method connection between the elements is performed due to the distributed normal and shear springs that hove been defined on element sides. After the calculation of stiffness of the connection springs, stiffness matrices of each pair of normal and shear springs should be done. Stiff nesses matrices of each pair of normal and shear springs are 6*6 and they'll assembles to build the global stiffness matrix. Boundary condition are affected on the global stiffness matrix and due to the external load vector applied on structure, internal displacement vector is calculated. In this case, if the normal strains exceed from the limit of linear behavior of the material, modification of step due to calculation of modification step factor necessary. As loading increase, the effect of large displacement in detection of structure plays a major role and should be applied on the response of structure. In this method the problem is solved by controlling the equilibrium equations and calculation of unbalanced forces in each step. These forces are applied as an external load in the next step. At the end, due to prepare software, different example such as cantilever, steel I-section beam and reinforce concrete frame under lateral force is performed. In geometrical and material nonlinear cases, the results had compatibility with FEM results, but in IAEM there is no sensitivity to the number of steps of loading in material nonlinear analysis and convergence of solution is resulted in all of the models. To put in nutshell IAEM is a proper and fast method for estimation of structural response, in material and geometrical nonlinear cases.