

The Role of the Elastic Foundation Having Nonlinear Stiffness Properties in the Vibration of Structures

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Abstract : A vibration is a mechanical phenomenon whereby oscillations occur about an equilibrium point. Although vibrations can be linear or nonlinear depending on the basic components of the system, the interest is mostly pointed towards nonlinear vibrations. This is because most structures around us are to some extent nonlinear and also because we need more accurate values in an analysis. The goal of this research is the integration of nonlinearities in the development and validation of structural models and to ameliorate the resistance of structures when subjected to loads. Although there exist many types of nonlinearities, this thesis will mostly focus on the vibration of free and undamped systems incorporating nonlinearity due to stiffness. Nonlinear stiffness has been a concern to many engineers in general and Civil engineers in particular because it is an important factor that can bring a good modification and amelioration to the response of structures when subjected to loads. The analysis of systems will be done analytically and then numerically to validate the analytical results. We will first show the benefit and importance of stiffness nonlinearity when it is implemented in the structure. Secondly, We will show how its integration in the structure can improve not only the structure's performance but also its response when subjected to loads. The results of this study will be valuable to practicing engineers as well as industry practitioners in developing better designs and tools for their structures and mechanical devices. They will also serve to engineers to design lighter and stronger structures and to give good predictions as for the behavior of structures when subjected to external loads.

Keywords : elastic foundation, nonlinear, plates, stiffness, structures, vibration

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