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# Natural Frequency Analysis of a Porous Functionally Graded Shaft System

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**Abstract :** The vibration characteristics of a functionally graded (FG) rotor model having porosities and micro-voids is investigated using three-dimensional finite element analysis. The FG shaft is mounted with a steel disc located at the midspan. The shaft ends are supported on isotropic bearings. The FG material is composed of a metallic (stainless-steel) and ceramic phase (zirconium oxide) as its constituent phases. The layer wise material property variation is governed by power law. Material property equations are developed for the porosity modelling. Python code is developed to assign the material properties to each layer including the effect of porosities. ANSYS commercial software is used to extract the natural frequencies and whirl frequencies for the FG shaft system. The obtained results show the influence of porosity volume fraction and power-law index, on the vibration characteristics of the ceramic-based FG shaft system.

**Keywords :** Finite element method, Functionally graded material, Porosity volume fraction, Power law
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