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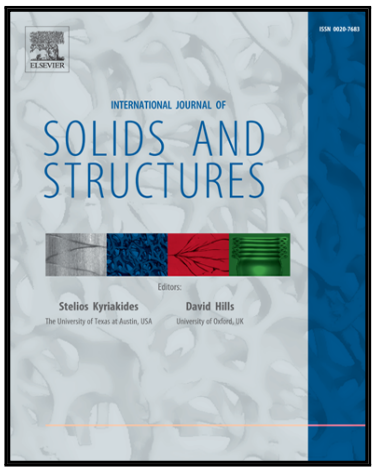

Elastomeric Bearing Sizing Analysis Part 1:Spherical Bearing

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Elastomeric Bearing Sizing Analysis
Part 1:Spherical Bearing

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Abstract

This analysis covers rigorous development of theoretical equations (based on linear elasticity and the assumption of rigid shims) used in the following bearing sizing computer programs for general three-dimensional loading. Part 1: Spherical Single Pad, Spherical Multilayer. Part 2: Flat (and circular) Single Pad, Flat Multilayer, Partial Cylinder (single and multilayer), Complete Cylinder (single and multilayer). Essentially the same methodology is used for spherical, flat and cylindrical bearings, and thus the theory is very detailed for only the spherical bearing. For the two others the analysis is less detailed and differences in the theory, if any, are noted. These equations have been programmed using Mathcad embedded in Excel for ease of use by the designer. The accuracy of the predictions has been extensively checked by linear finite elements. After preliminary designs are established by using Mathcad or other programs based on the theory, final design may be done with finite elements, accounting for rubber nonlinearity and shim deformation. Lastly, some comparisons of all five basic spring constants from Mathcad are made using linear finite element predictions (all as a function of shape factor), followed by examples of the effect of shape factor on shear strain and mean stress.A third paper, Spherical Shim Analysis for Elastomeric Bearings, has been submitted.

Key Words: Elastomeric Bearings, Rubber, Solid Mechanics, Linear Elasticity, Design Equations

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