GRADUATE STUDENT RESEARCH SEMINAR SERIES (2021)

PARAMETRIC STUDY OF ORTHOGONAL PANTOGRAPHIC LATTICE WITH NON-LINEAR TORSIONAL RESISTANCE BETWEEN PIVOTS

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The mechanical response of pantographic lattice is analyzed for a series of elongation tests for linear and non-linear geometry under large deformations. The beam model of orthogonally oriented lattice is constituted by torsional springs at intersection points which dictate the internal moments. The torsional stiffness of the spring is varied from zero to infinite to replicate a free and rigid connection respectively between the intersecting beams.

The linear torsional spring is mimicked in a discrete frame model to validate the results. The results are also verified with the homogenized models of the lattice. Later, a non-linear torsional spring is utilized to create softening (damping) and stiffening effects. The material non-linearity created via this spring is studied for comparing elastic constants of the spring versus the entire lattice model. The non-linearity is a function of two parameters and is driven by the angle of rotation. The goal of the study is to analyze the effects of parameters such as spring stiffness and the effects of geometric and material non-linearity. The pantographic lattice has also been extended in 3D where every pivot is constituted by three torsional springs very similar to the ones used in 2D.

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EIB 132