

Poisson's Ratio Assessment of Different Auxetic Structures With and Without Nonlinear Geometric Effects

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Abstract

Unlike traditional materials, when an auxetic material is stretched, it expand laterally and when it is compressed, it tend to get thinner. These extremely unusual materials do not defy the laws of elasticity theory. It is only in the last 12 years that any such material also known as negative Poisson's ratio material has been fabricated. In this paper different shape of auxetic structures such as anti-tetra-chiral, missing rib structure, re-entrant structures have been evaluated numerically and analytically to investigate the Poisson ratio of different structural shapes.

Keywords: Auxetic materials, negative Poisson's ratio, ABAQUS, nonlinear geometric effects

1. Introduction

It is not uncommon in texts that all materials possess a positive Poisson's ration, however the possibility that Poisson ratio may also be negative has been accepted in classical elasticity theory for over 150 years.

$$-1 \leq \nu \leq 0.5 \quad (1)$$

Fig. 1 shows two different type of materials. a) is conventional honeycomb structure with positive Poisson's ratio and b) is auxetic honeycomb structure and how they deform .

