

Dynamic Response of Magnetorheological Fluid Tapered Laminated Beams Reinforced with Nano-Particles

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Abstract : Non-uniform laminated composite structures are being used in many engineering applications where the structures are subjected to unpredicted vibration. To mitigate the vibration response of these structures, recently, magnetorheological fluid (MR), is added to non-uniform (tapered) thickness laminated composite structures to achieve a new generation of the smart composite as MR tapered beam. However, due to the nature of MR fluid, especially the low stiffness, MR tapered beam exhibit lower stiffness and in turn, lower natural frequencies. To achieve the basic design requirements of the structure without MR fluid, one may need to apply a predefined magnetic energy to the structures, requiring a constant source of energy. In the present work, a passive initial stiffness control of MR tapered beam has been studied. The effects of adding nanoparticles on the dynamic response of MR tapered beam has been investigated. It is observed that adding nanoparticles up to 3% may significantly modify the natural frequencies of the structures and achieve dynamic behavior of the structures before addition of MR fluid. Two Models of tapered structures have been taken into consideration. It is observed that adding only 3% of nanoparticles backs the structures to its initial dynamic behavior.

Keywords : non uniform laminated structures, MR fluid, nanoparticles, vibration, stiffness

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