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Fixed-Free single walled boron nitride nanotube based mass sensor

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This paper, illustrates the dynamic behavior of fixed-free single walled boron nitride nanotubes (SWBNNTs) based nanomechanical resonator using finite element method (FEM). To this end, molecular structural mechanics based 3-dimensional atomistic model developed such that proximity of the model to the actual atomic structure of nanotube is significantly retained. Different types of zigzag and armchair layups of SWBNTs are considered with fixed-free end constraints. Implementing finite element simulation approach, the effect on resonant frequency shift due to size variation in terms of length as well as diameter is explored by considering nanotubes of different aspect ratios. The nanoscale mass sensitivity of cantilevered SWBNNT based nanomechanical resonator is analyze based on resonant frequency shift variation due to additional mass. Also effect on resonant frequency shift variation due to atomic structure of the nanotube for same size is analyzed. The continuum mechanics based analytical analysis performed considering effective thickness of the SWBNNTs. The finite element method (FEM) based simulation results are compared with the analytical results and found in good agreement as a one of the toolkits for systematic analysis approach for novel design of SWBNNT based nanomechanical resonators. The present approach is found to be effectual in terms of dealing different chiralities, boundary conditions and consideration of added mass to analyze the dynamic behavior of the fixed-free SWBNNT based nanomechanical resonators.

Biography

S. P. Harsha working as an Associate Professor in Mechanical & Industrial Engineering Department, Indian Institute of Technology Roorkee. His area of research is Dynamics and Controls of CNT/BNNT based nano-resonators, nano-composites, Mechanical vibrations etc. He has published almost 80 International Journal papers and 75 International Conf.

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