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Research Interests:

Multi-scale analysis;

Nanomechanics;

Low-Dimension Structures;

Carbon Nanotubes; Graphene sheets

Nano-fiber reinforced Composites

Computational methods for Nanostructural analysis

Present Research Focus:

Because of the novel mechanical and electronic properties, recently nanomaterials based structures have engrossed great deal of attention of the scientific community. As controlled experiments in nanoscale are difficult, theoretical and computational analysis of nanostructures is an important issue concerning its applications. Due to the in-built discreteness of the nanostructures (carbon nanotubes and graphene sheets), atomistic methods such as molecular dynamics (MD) are generally applied to study the physical behavior of nanostructures. However these methods are limited by high computational capacities. Consequently continuum modeling is receiving increasing attention for nanostructural analysis. Typical nanostructures include nanobeams, nanoplates, nanopeapods, nanorings, nanocones, nanoshells, CNTs etc.

Both experimental and atomistic simulation results have shown a significant ‘size-effect’ in mechanical properties when the dimensions of these structures become small. Size effects are related to atoms and molecules that make up materials. At nanometer scales, size effects often become prominent. As the length scales are reduced, the

influences of long-range inter-atomic and intermolecular cohesive forces on the static, buckling and dynamic properties tend to be significant and cannot be neglected. Our research group focuses on developing and simulating advanced theoretical and computational nano-scale models for accurately analyzing the mechanical characteristics of nanostructures with integration of 'nano' effects.

Keywords: **Nanostructures; Multi-scale mechanics; Carbon Nanotubes; Graphene Sheets**

Recent Publications:

- **Murmu T**. and Pradhan, S. C., "Buckling analysis of single-walled carbon nanotubes embedded in an elastic medium based on nonlocal elasticity and Timoshenko beam theory and using DQM." **Physica E: Low-Dimensional Systems and Nanostructures**, 2009, Volume 41, Issue 7, Pages 1232-1239

- **Murmu T**. and Pradhan, S. C., "Small scale effect on the free in-plane vibration of nanoplates by nonlocal continuum model", **Physica E: Low-Dimensional Systems and Nanostructures**, 2009, Volume 41, Issue 8, Pages 1628-1633

- S. C Pradhan and **T Murmu**., Vibration analysis of a single-walled carbon nanotubes embedded in an elastic medium based on nonlocal elasticity and Timoshenko beam theory, **Journal of Applied Physics**, American Institute of Physics (AIP) archival journal 2009, Volume 105, No. 124306 (Selected for the volume 20, issue 1 (2009) of **Virtual Journal of Nanoscale Science & Technology**)

- **Murmu T** and Pradhan, S. C., "Small-Scale Effect on the Vibration of Nonuniform Nanocantilever based on Nonlocal Elasticity Theory", **Physica E: Low-Dimensional Systems and Nanostructures**, 2009, Volume 41, Issue 8, Pages 1451-1456

- Murmu T. and Pradhan, S. C., "Thermo-mechanical Vibration of a Single-Walled Carbon Nanotube Embedded in an Elastic Medium based on Nonlocal Elasticity Theory" **Computational Materials Science**, 2009, Volume 46, Issue 4, Pages 854-859