National Institute of Technology Rourkela

Synopsis Seminar

Seminar Title	: Dynamic Analysis and Stability Studies in Functionally Graded Porous Microstructures
Speaker	: Uttam Kumar Kar (Rollno : 519me1017)
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Venue	: SEMINAR ROOM (ME)
Date and Time	: 19 Jul 2024 (04.15 pm)
Abstract	: Functionally graded low-dimensional order structures with high strength to weight ratios, good energy efficiency, absorption ability and high thermal conductivities have wide usage in MEMS/NEMS applications.Present work focuses on the dynamic analysis and control studies of microstructural components used in MEMS applications with functionally graded materials under different loading conditions. Modified couple stress theory with higher order beam theory & refined plate theory are employed to capture the effective dynamics with size effects. Bi-directional functional grading with porosity, damping, environmental effects (humidity, temperature) are considered in the design. The dynamic equations are derived and solved using the finite element approach with in built programs. Parametric analysis is conducted to know the effective parameters on the free vibration and transient characteristics of FG microbeams/plates under impact/thermal shock loads. Further samples are fabricated and experimental studies are conducted for microscopic examination and mechanical characteristics. Several optimized design formulations are presented to obtain best geometry and material properties using surrogate model based optimization scheme with firefly algorithm. Dynamic analysis of FG sandwich microbeams is also illustrated and vibro-acoustic analysis for sound pressure level studies on FG microbeams are presented. The pull-in analysis and stability control are studied with adaptive back-stepping sliding mode control scheme. As two case studies, a coupled beam resonator mass sensor and microaccelerometer designs are shown with their dynamic performance features.