National Institute of Technology Rourkela

Defence Seminar

Seminar Title	: Theoretical and Experimental Analysis of Large Deformation Induced Damaged Composite Structure using Elastic/Elastoplastic Properties under High Strain Loading Conditions
Speaker	: Vikash Kumar (Rollno : 519me1024)
Supervisor	: Prof. Subrata Kumar Panda
Venue	: Seminar Hall (Ground Floor, ME-001), Mechanical Engineering Science Building, https://meet.google.com/mrk-jrrb-qbz
Date and Time	: 27 Jan 2025 (3.00PM)
Abstract	: This study examines the geometrically linear/nonlinear analysis of laminated curved shell panels that have damage under mechanical loading. The numerical responses are evaluated computationally via a higher-order finite element (FE) formulation to estimate the responses, i.e., static bending, free vibration, and transient deflection under elastic/elastoplastic conditions at normal and high strain rates. The layered curved shell model is derived mathematically using an equivalent single-layer theory based on the third-order displacement variables. Moreover, the Green Lagrange nonlinear strain terms have been used mathematically to introduce the geometrical nonlinearity within the structure. The nonlinear governing equation of motion utilizes Hamilton's principle for the layered structure having damages. The approximate nonlinear numerical solutions are computed using the isoparametric FE technique utilizing Gauss-Quadrature integration in association with Picard's direct iterative method. The discretization of the curved shell panel is accomplished using the quadrilateral Lagrangian element with nine-node considering ten degrees of freedom per node. A generic computational approach has been adopted in MATLAB using the existing nonlinear mathematical formulation considering all nonlinear higher-order terms to retain the required generalization. Initially, the consistency of the developed numerical model is checked with an adequate number of convergence tests. Similarly, the derived model accuracy is verified further using a comparison test with the available published results (numerical and analytical). The numerical findings are equated with the experimental results for the second stage verification using the available lab-scale test rig. The observed difference between the experimental and numerical values is within an acceptable range of 10%. For a comprehensive understanding of the damaged structural modelling, the impact of damages, including the different geometrical factors, loading conditions, and edge-support conditions, is examined further.