

ADVANCED MATERIALS AND SMART STRUCTURES

RESEARCH GROUP: Giovanni Castellazzi, Stefano de Miranda, Elena Ferretti, Cristina Gentilini, Lucio Nobile, Giovanni Pascale, Francesco Tornabene, Francesco Ubertini, Erasmo Viola.

KEYWORDS: shape memory alloy, FGMs, FRP, multistable structure, Carbon Nanotubes, Variable Angle Tow.

The research focuses on advanced ad-hoc developed formulations and numerical analysis for modeling the behavior of structural components constituted by innovative materials. Recently, a research line on morphing/bistable structures has been started in collaboration with the Department of Engineering at the University of Cambridge.

Morphing structures can undergo large changes of shape without plastic deformations giving the potential for large improvement in cost, weight and reliability.

The research touches numerical simulations for the analysis of shape and stiffness control of slender structures using shape memory alloys components.

The following topics are under study:

- Functionally Graded Materials (FGMs) and Functionally Graded Carbon Nanotube (FG-CNT) reinforced plates and shells;
- interface behaviour in FRP reinforced structures;
- enhanced strength in FRP wrapped concrete columns. The flexural behaviour of concrete beams cracked and strengthened with fiber reinforced polymers has been studied based on fracture mechanics concepts. The dynamic behaviour has been investigated too, for estimating the variations due to cracking and subsequent strengthening on vibration modes, frequencies and damping;
- multistable structures (corrugated plates);
- finite element approaches for electroelasticity problems;
- finite element approaches for laminated composites;
- laminated panels with curvilinear reinforcing fibers (Variable Angle Tow composites).

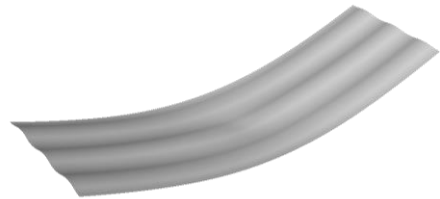


Fig. 1. Multistable corrugated plate (Gentilini).

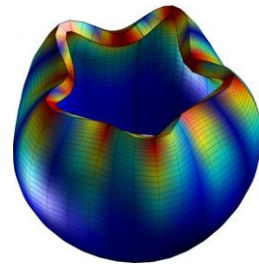


Fig. 2. Spherical shell (Tornabene).

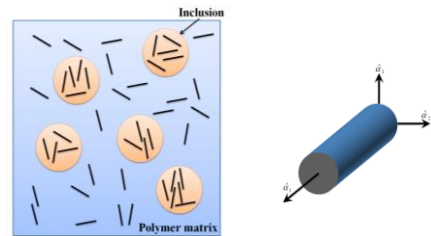


Fig. 3. Agglomeration model for CNTs (Tornabene).

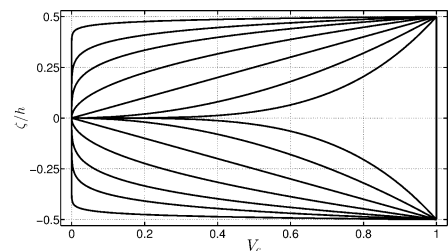


Fig. 4. Through-the-thickness variation of the mechanical properties of a FGM structure (Tornabene).

MAIN PUBLICATIONS

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RESEARCH PROJECTS

Active and passive reinforcements by means of composites for the technologic innovation of the civil structures., PRIN2002 – Bologna Research Unit. Coordinator: Prof. G. Pascale.

CONTACTS

cristina.gentilini@unibo.it
francesco.tornabene@unibo.it