



The strength of ultralightweight solids: from membranes to architected materials

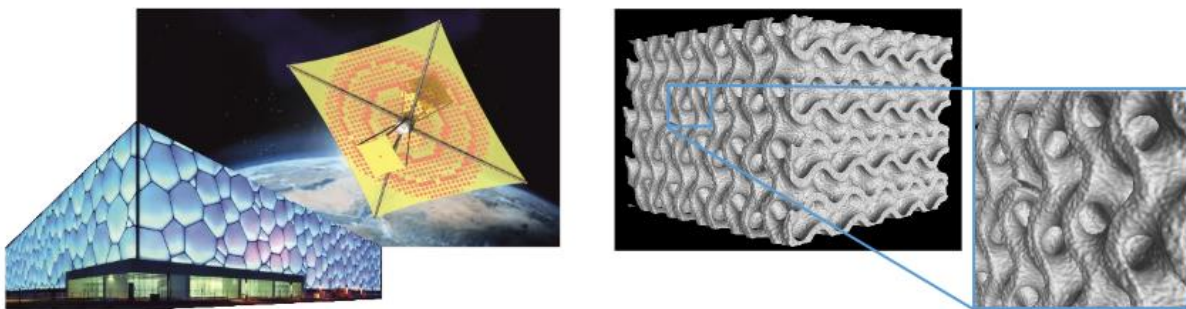
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Date	3 May 2024
Time	9.30–10.30
Room	2R, DICAM, Mesiano

Abstract

Abstract: From nature to engineering applications, the quest for ultralightweight and strong materials drives the progress toward highly efficient systems. In this framework, membranes and cellular solids represent two classes of materials that offer unmatched strength-to-weight ratios. The talk discusses advances in the modelling, design and characterisation of ultralightweight solids to enhance their mechanical properties and promote their use in several engineering applications. In the first part, we present a new imaging technique to precisely characterise the yield strength of membrane materials, thus overcoming the limitations of the available experimental methods. In the second part, we demonstrate how the mechanical properties of lightweight metamaterials can be enhanced by altering their architecture by redistributing solid material along the cell walls. Analytical calculations, finite element simulations coupled with Bayesian machine learning and experiments are performed to maximise the stiffness, yield and buckling strength of architected materials.



Left: applications of structural membranes in building façades and space engineering. Right: computed tomography images of an additively manufactured carbon microlattice with cell wall size $<100 \mu\text{m}$.

The seminar is organized by the Solid and Structural Mechanics Group [D. Bigoni, F. Dal Corso, L. Deseri, D. Misseroni, M.F. Pantano, A. Piccolroaz, N.Pugno, R. Springhetti]