Unione Europea

Ministero dell'Istruzione, dell'Università e della Ricerca

Università degli Studi di Salerno

DIPARTIMENTO DI INGEGNERIA CIVILE

Dottorato di Ricerca in *Ingegneria delle Strutture e del Recupero Edilizio e Urbano*

Il giorno **31 ottobre 2016** dalle ore **10:00 alle 11:00** presso l'**Aula Multimediale** del Laboratorio di Strutture, i

Prof. Davide Bigoni e Prof. Francesco Dal Corso

dell'Università di Trento, terranno i seguenti seminari:

Davide Bigoni (10:00-10:30):

Folding as an instability of a three-dimensional elastic solid

Extreme elastic materials are designed to work near a material instability, where they display stress channelling and strain localization, effects that can be exploited in several technologies. Extreme couple stress solids are introduced and systematically analyzed in terms of several material instability criteria: positive definiteness of the strain energy (implying uniqueness of the mixed b.v.p.), strong ellipticity (implying uniqueness of the b.v.p. with prescribed kinematics on the whole boundary), plane wave propagation, ellipticity, and the emergence of discontinuity surfaces. Several features are highlighted: (i.) Ellipticity is mainly dictated by the 'Cosserat part' of the elasticity and (ii.) its failure is shown to be related to the emergence of discontinuity surfaces; (iii.) Ellipticity and wave propagation are not interdependent conditions (so that it is possible for waves not to propagate when the material is still in the elliptic range and, in very special cases, for waves to propagate when ellipticity does not hold) [1]. The antiplane strain Green's functions for an applied concentrated force and moment are obtained for Cosserat elastic solids with extreme anisotropy and used to show that the wave propagation condition (and not ellipticity) governs the behavior of the antiplane strain Green's functions. These Green's functions are used as perturbing agents to demonstrate in an extreme material the emergence of localized (single and cross) stress channelling and the emergence of antiplane localized folding (or creasing, or weak elastostatic shock) and faulting (or elastostatic shock) of a Cosserat continuum, phenomena which remain excluded for a Cauchy elastic material. During folding some components of the displacement gradient suffer a finite jump, whereas during faulting the displacement itself displays a finite discontinuity [2].

[1] P.A. Gourgiotis, D. Bigoni (2016). Stress channelling in extreme couple-stress materials Part I: Strong ellipticity, wave propagation, ellipticity, and discontinuity relations J. Mech. Phys. Solids, 88, 150-168.
[2] P.A. Gourgiotis, D. Bigoni (2016). Stress channelling in extreme couple-stress materials Part II: Localized folding vs faulting of a continuum in single and cross geometries J. Mech. Phys. Solids, 88, 169-185.
[3] D. Bigoni and P.A. Gourgiotis (2016). Folding and faulting of an elastic continuum. Proc. Royal Soc. A, 472, 20160018.

Francesco Dal Corso (10:30-11:00):

The elastica compass and the elastica catapult

Features emerging from non-linear analysis and experimental testing are presented with reference to an elastic cantilever rod considered within the large rotation regime. As a cantilever rod, its free end subject to a dead load P but its clamp is described with a generic inclination α, slowly varying in time. The analytical solution of the elastica, defined through elliptic integrals, disclose uniqueness and non-uniqueness of the quasi-static equilibrium configuration at fixed clamp inclination depending on the amount of the hanged load P. In particular, it is shown that during a monotonic increase of the clamp angle, the equilibrium configuration changes continuously when $P \leq Pcr$, so that the end of the rod describes a (smooth, convex and simple) closed continuous curve and the system behaves as an 'elastica compass'. Differently, when $P > Pcr$, when the clamp rotation approaches a critical value, the system shows a jump in the equilibrium configuration, so that the structure behaves as an 'elastica catapult'.

Il Coordinatore del Dottorato
Prof. Ing. Ciro Faella