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"**Generalized continuum theories and applications to engineering sciences**".

Abstract :

Generalized continuum theories are nowadays recognized to be a useful tool for the macroscopic description of the mechanical behavior of materials with heterogeneous microstructures showing exotic properties and/or size effects. A vast literature exists concerning the development of “second gradient”, “couple stress”, “Cosserat”, “micropolar”, “micromorphic” models which dates back to the works of Cosserat brothers, Mindlin, Toupin, Germain, Eringen, Bleustein, etc. Such generalized continuum theories experience today a vehement revival since it becomes more evident which are their potentialities concerning the mechanical description of micro-structured materials. We propose to present and compare a class of such generalized theories and to individuate some of their possible applications which may be worth to be further studied in view of technological innovation. In particular, we will insist on a newly introduced particular micromorphic model, which we called “relaxed micromorphic”, that has been shown to be well-adapted to describe very exotic behaviors of micro-structured materials in the dynamic regime. In particular, a relaxed micromorphic model is, to our knowledge, the only generalized continuum model which is able to describe complete band gaps with respect to wave propagation. Such relaxed micromorphic model also gives rise to some very intriguing mathematical questions regarding its well-posedness.