



SHORT COMMUNICATION

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Workshop “Micropolar continua and beyond”

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Abstract We present a review of the recent workshop “Micropolar Continua and beyond” which held in March 28–31, 2023, at Technische University of Berlin, Germany.

Keywords Micropolar continua · Strain gradient media · Non-local models · Lattice · Generalized media

The workshop “*Micropolar continua and beyond*” was held in March 28–31, 2023 at the Technische Universität Berlin, Germany. The topics of the workshop included theoretical, numerical and experimental studies within generalized continuum models. The term *Generalized Continuum Theories (GCTs)* includes various enhanced models of media such as MMM theories (micropolar, microstretch and micromorphic), couple-stress theory, liquid crystals, strain- and stress-gradient elasticity, peridynamics, flexoelectricity, flexomagnetism, and many others. GCTs are most useful for materials science because they are needed for modeling high-performance materials carrying an “inner structure” or “additional internal degrees of freedom.” Such materials occur in solid or liquid form or in an “in-between form,” such as granular substances. A particular form of GCT is micropolar theory. It emphasizes the aspect of inner rotational degrees of freedom of a material containing “particles” on a mesoscopic scale. It dates back to the work of the Cosserat in the 19th century, followed by a revival in the late fifties and mid-sixties of the last century, however, without concrete practical applications in engineering. As it was indicated above, the situation has changed now. Nowadays, the essential growth of the interest in such models relates to significant extension of structural and continuum mechanics toward new materials and new scales. During the workshop, attention was paid on the most recent research items, i.e., new generalized models, materials with significant microstructure, multi-field loadings, or identification of constitutive equations. Last but not least, a comparison with discrete modeling approaches was discussed.

During the workshop, the lectures were delivered from the leading scientists from Germany, France, Italy, Sweden, Israel, Estonia, and Ukraine. The given lectures cover the following topics:

- Ellipticity and material instability within nonlinear generalized continua;
- Thermomechanics of shear banding in elastoplastic Cosserat media;
- Micropolar and micromorphic simulation of elastic and plastic behavior of foams;
- Micropolar theories to modeling of carbon nanotubes;
- Micropolar elasticity as a model of elastic networks with rigid massive joints;
- Cosserat point as structural element for masonry modeling;

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Fig. 1 Participants of the Workshop “Micropolar continua and beyond”, March 28–31, 2023, Berlin, Germany

- Short fiber reinforced concrete modeling;
- Electrodynamics as a micropolar generalized continuum theory;
- Homogenization of lattices toward strain gradient continuum;
- Damage mechanics of metamaterials using strain gradient elasticity approach;
- Coupled strain gradient elasticity, reciprocity, Betti’s theorem, and Saint-Venant principle;
- Interactions within the third strain gradient elasticity;
- Discrete to non-local continuum transition with applications to composites and masonries;
- Non-local fractional models of rods, beams, and plates having lattice-type microstructure;
- Higher-order theory of beams with inner lattice-type structure;
- Discrete and continuum modeling of fibrous bio-inspired materials;
- Boundary conditions for some generalized models including strain gradient fluids;
- Peridynamics for plates and for dynamic fracture;
- FEA for flexoelectricity; and
- Numerical analysis of cylindrical solids with complex properties.

The book of abstracts could be found on the site of TU Berlin <https://www.tu.berlin/en/lkm/event-details>.

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