



MetaMEMS: a new trend in Microsystems technology

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In the last decades, there has been an exponential growth of research activities in the field of mechanical metamaterials like phononic crystals and auxetic materials [1]; metamaterials and metastructures are now being transformed in engineering applications. In parallel, the world of Micro Electro Mechanical Systems (MEMS), or Microsystems [2], has evolved from academic research to a whole Industrial Sector at the basis of Internet of Things and of the new industrial revolution 4.0.

The cumulated experience in the field of metamaterials on one side and the integration of new fabrication steps in the world of Microsystems on the other side, allow today for a fruitful merge of metamaterials concepts in MEMS, thus creating the opportunity to realize Meta-MEMS as a possible new trend in Microsystems technology [3].

The seminar will present recent results obtained in the field of metamaterials for MEMS, partially inspired by previous works (see e.g. [4]) on mechanical metamaterials. Auxetic structures were obtained in [5], while metaplates were used in [6] and [7] for vibration isolation at the meso and micro scale, respectively. More recently, planar lenses for wave focusing were studied and fabricated at the meso-scale [8], they are now being transformed in micro-devices.

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[3] Zhao, X., Duan, G., Li, A., Chen, C., Zhang, X., "Integrating microsystems with metamaterials towards metadevices", *Microsystems and Nanoeng.*, 5, 1-17, (2019).

[4] D'Alessandro, L., Belloni, E., Ardito, R., Corigliano, A., Braghin, F., "Modeling and experimental verification of an ultra-wide bandgap in 3D phononic crystals", *Applied Physics Letters*, 109 (22), 221907 (2016).

[5] Zega, V., Nastro, A., Ferrari, M., Ardito, R., Ferrari, V., Corigliano, A., "Design, fabrication and experimental validation of a MEMS periodic auxetic structure", *Smart Materials and Structures* 28(9), 095011, (2019).

[6] Yao, Z., Zhao, R., Zega, V., Corigliano, A., "A metaplate for complete 3D vibration isolation", *European J. Mech.: A Solids*, 84, 104016, (2020).

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[8] Antonacci, M., Riva, E., Frangi, A., Corigliano, A., Zega, V., "Planar GRIN lenses: numerical modelling and experimental validation", *J. of Sound and Vibration*, 537, 117217, (2022).