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Supervisor Expression of Interest MSCA - Marie Sklodowska Curie Action - (PF) Postdoctoral Fellowship 2024

Supervisor name: prof ing. Roberto Fedele

Email address: roberto.fedele@polimi.it

Link pagina docente:

https://www4.ceda.polimi.it/manifesti/manifesti/controller/ricerche/RicercaPerDocentiPublic.do?E_VN_PRODOTTI=evento&k_doc=64302&polij_device_category=DESKTOP&_pj0=0&_pj1=9599b6917b67cc453b6e328eae6b3646

Department Name: Department of Civil and Environmental Engineering (DICA):

Research topic: **Inverse analysis, identification, characterization of materials;
Advanced composites and Metamaterials**

(<https://www.dica.polimi.it/research/sections/mechanical-of-materials-and-structures-section/?lang=en>)

MSCA-PF Research Area Panels:

- ECO_Economic Sciences
- ENG_Information Science and Engineering**
- ENV_Environmental and Geosciences
- LIF_Life Sciences
- MAT_Mathematics
- PHY_Physics
- SOC_Social Sciences and Humanities
- CHE_Chemistry

Brief description of the Department and Research Group (including URL if applicable):

DICA is the 7th Department of Civil and Structural Engineering in the world, the first in Italy, according to “QS world ranking 2019”, with 2 doctoral schools, about 100 members of permanent staff and 80 as non-permanent staff. With its 8 inner sections DICA covers all topics of civil and environmental engineering, with a peculiar expertise in experimental (both in laboratory and in situ) and numerical activities, for the following areas: structural, geotechnical and earthquake engineering, transport infrastructures, water research, geomatics, environmental engineering. DICA is an excellent scientific institution devoted to innovative research, education, and to commitments from



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public and private entities in all aforementioned disciplines. <http://www.dica.polimi.it/>. Prof. Roberto Fedele is responsible for the laboratory of “Full-field measurements” at Dept. DICA; he is in the scientific commission of “AMALA” interdepartmental lab; currently, he is supervisor of one post-doc at DICA, co-supervision of a few PhD students of other universities and can count on several scientific collaborations inside Politecnico and abroad.

See also:

www.robertofedele.it

<https://www.dica.polimi.it/ricerca-2/laboratori-di-ricerca/laboratorio-mems-micromeccanica-e-misure-di-campo>

<https://www.dica.polimi.it/research/sections/mechanical-of-materials-and-structures-section/?lang=en>

Title of the project: **Inverse problems for generalized materials**

Brief project description:

Starting from the seminal works of Toupin, Mindlin and Germain, a wide class of generalized elastic models have been proposed via the principle of virtual work from postulating expressions of the elastic energy enriched by additional kinematic descriptors or by higher gradients of the placement, referred to respectively as higher order and higher grade models. During the last decade, more and more often such models have been applied with the aim to interpret several phenomena concerning micro and nano-structures, such as (nano-)beams, wires, belt, films, frequently met in MEMS/NEMS applications. The data gathered so far, which have revealed size-dependence of the apparent moduli in statics, shift of natural frequencies, dispersion of waves with optical modes and possible band gaps in dynamics, are not consistent with a Cauchy-Born continuum. This project, focusing on generalized elastic continua, will be articulated into the following tasks: (i) develop mixed static-dynamical identification strategies, to calibrate the high number of parameters governing such models, after exploiting symmetry classes and reduced order formulations; (ii) design non conventional experiments at different scales, including also exotic, non-standard loading conditions, exploiting images from advanced scanning with in situ loading by DIC procedures; (iii) focusing on discrete lattices at the microscale, resting on theoretical results so far achieved, specify the widest class of microscopic configurations which give rise, through homogenization, to generalized behaviors at the macroscale.