MULTIPHYSICS AND COUPLED PROBLEMS

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This research line encompasses the development of ad-hoc numerical formulations for the analysis of several coupled problems.

In particular, tools are developed for:

- numerical simulation of wind tunnel tests by means of LES (Fig. 1) and generation of synthetic turbulence;
- dynamic structural response to the wind action and extraction of Equivalent Static Wind Loads;
- assessment of the aeroelastic stability of structures by means of Computational Fluid Dynamics;
- simulation of phase transition in metals using phase field model with applications to steel and shape memory alloys (Fig. 2);
- simulation of the mechanically driven mass diffusion in deformable solids, aimed at predicting the so-called hydrogen embrittlement, which may occur in metals containing an initially uniform dilute concentration of hydrogen;
- simulation of the effect of the diffusion of moisture within the masonry on the mechanical response as well as of the effect of the mechanical degradation on the diffusion process;
- simulation of the moisture diffusion and salt transport in porous media with attention to the stress and damage prediction (Fig. 3).

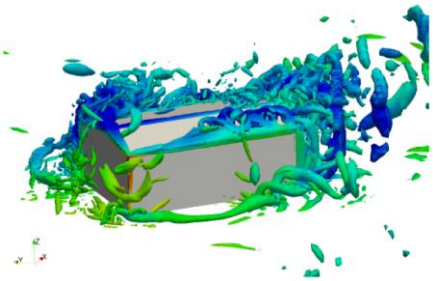

Fig. 1. Instantaneous vorticity contours around a low-rise building (Patruno).

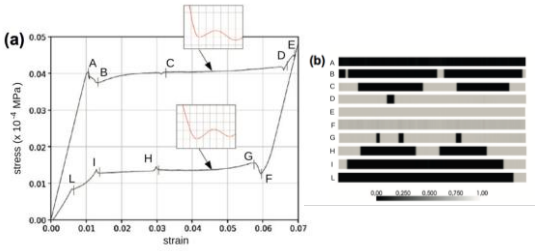

Fig. 2. Simulation of tensile test in NiTi shape memory alloy, stress-strain prediction and phase morphology at different stages (Molari).

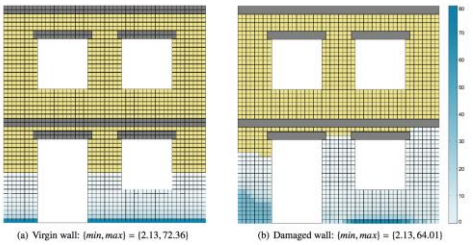

Fig. 3. Water uptake on two-storey wall: water content distribution for (a) virgin masonry wall, (b) a damage masonry wall (Castellazzi).

MAIN PUBLICATIONS

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RESEARCH PROJECTS

KISADAMA - Kinetics of Salt Crystallization and Mechanical Damage in Historic Masonry (2013-2016), JPI - JOINT HERITAGE EUROPEAN PROGRAMME (www.kisadama.eu).

PERCER - Innovazione di processo PER la filiera della piastrella CERamica sostenibile (2016-2018), POR-FESR 2014-2020.

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