The 8th European Congress on Computational Methods in Applied Sciences and Engineering
ECCOMAS Congress 2022
5 – 9 June 2022, Oslo, Norway

INTELLIGENT SYSTEM BASED ON MAGNETORHEOLOGICAL ELASTOMERS TO STIMULATE BIOLOGICAL MATERIALS

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Key Words: *Multifunctional materials, Mechanobiology, Multi-scale, Magnetorheological elastomers.*

Current research in biomechanics and mechanobiology faces critical limitations to control the mechanical environment (i.e., deformation, stiffness) of biological systems without compromising them. A significant limitation exists in the real-time control and remote actuation of the mechanical environment. We present a novel experimental framework to modulate the mechanical properties of cell substrates using magnetorheological elastomers (MREs). These composites consist of an elastomeric matrix filled with magnetic particles that, under the actuation of an external magnetic field, responds by mechanically deforming [1]. We demonstrated reversible mechanical changes in substrates of more than one order of magnitude in stiffness and large local deformations. In parallel, we developed a multiscale computational model to simulate the coupling between magnetics and mechanics within the MREs. The whole experimental-computational framework is coupled to a customised imaging system for live cellular assays that allows for magneto-mechanical stimulation in real time. These results offer direct benefits for health purposes by paving the path to models to simulate dynamic mechanistic-mediated biological processes as well as testing and design of new therapeutics.

REFERENCES

[1] M.A. Moreno, J. Gonzalez-Rico, M.L. Lopez-Donaire, A. Arias, D. Garcia-Gonzalez, Composites Part B: Engineering, 224:109148, 2021.