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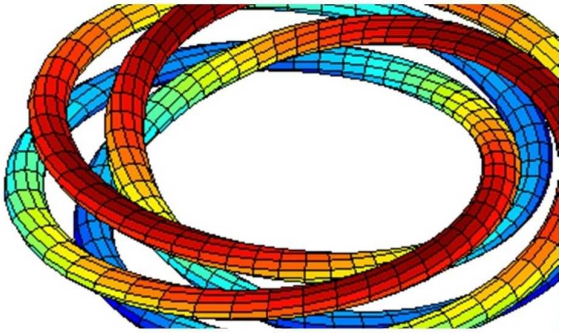

Abstracts

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APPLICATA E INDUSTRIALE

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Beyond the BEM Solution of the M/EEG Forward Problem: a Meshfree Approach

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Nowadays, the brain activity can be investigated non-invasively by means of electromagnetic techniques, namely electroencephalography (EEG) and magnetoencephalography (MEG). Such techniques require a typical inverse problem to be solved. Therefore, an accurate and fast forward solver has to be employed. As an alternative to the Boundary Element Method (BEM), which involves both complex meshing algorithms in the pre-processing stage and costly numerical integration routines, we propose the application of a truly meshfree solver for the numerical solution of the M/EEG forward problem, i.e., a set of coupled boundary value problems for the 3D Laplacian operator. The proposed method is based on the Method of Fundamental Solutions (MFS) and the Method of Particular Solutions (MPS), so it has potential for spectral accuracy and it is integration-free. Flexibility and remarkable simplifications in the pre-processing stage are also reached. Numerical experiments on spherical head geometries, for which analytical or

semi-analytical solution of the potential problem are known, show the potentiality of the proposed method when it is compared to the state-of-the-art BEM by considering both numerical accuracy and computational cost. Results of experiments conducted on real head geometries are also shown.

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