Effective EEG/MEG forward simulation through *hp*-FEM

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Electro/Magnetoencephalography (EEG/MEG) is an non-invasive imaging modality in which a primary current density generated by the neural activity in the brain is to be reconstructed from external electric potential/magnetic field measurements. This work focuses on effective and accurate simulation of the EEG/MEG forward model through the *hp*-version of the finite element method (*hp*-FEM). The goal is to show that the use of the *hp*-FEM in discretization of the electric potential can lead to better reconstructions as compared to the use of the classical *h*-FEM. An *hp*-FEM type forward simulation is described and implemented, and the related implementation issues are discussed. These issues include, for example, generation of sparse finite element meshes for realistic geometries through the use of different element types, and finding appropriate finite element enrichment techniques for specific mesh refinements. Suitable inversion methods to be used in the presence of accurate forward simulation are also considered.