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Coupling methods for problems in cardiac electrophysiology

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The refinement of non-invasive techniques to visualize the human tissues and to examine their functions allows remarkable advances. It is then profitable to take advantage of this huge amount of information to do more realistic numerical simulations. Starting from segmented medical images, some coupling methods for computing the electricity in the heart are explored according to a level set description of the domains. The results of numerical simulations on body-fitted meshes are compared with simulations on non-body fitted meshes with a level set description of the domains. The aim of this work is to show that one can avoid the step of generating a body-fitted mesh, and still having good properties of convergence. Finally, the problem of coupling the heart and the thorax is addressed with a less (memory) demanding model than the bidomain model with physiological ionic models. This way of tackling the problem is very promising because one could eventually use the same mesh and change the level set description in a case of a moving geometry (e.g. a heart beating). It would facilitate significantly the integration.