Interactive Source Imaging with BioPSE

David Weinstein, Leonid Zhukov, Chris Johnson, Steve Parker, Rob MacLeod, and Chuck Hansen

Scientific Computing and Imaging Institute University of Utah, Salt Lake City, UT 84112

Traditionally, solving bioelectric field problems has required a variety of non-integrated software tools. For example, to solve an EEG source localization problem using the finite element method, a "typical" computational pipeline might consist of: modeling programs for meshing the geometric domain, separate simulation programs for localizing the EEG source(s), and another set of programs for visualizing the results. One result of such disconnected stand-alone tools is that a great deal of time is required for editing files, re-compiling programs, converting data to different formats, and moving data from one program to the next. Most problematically, there is typically little opportunity for interactive investigation of model parameters or solution methods, since changing any component requires manually rerunning all of the subsequent components in the pipeline.

In this presentation, we will demonstrate BioPSE, an integrated problem solving environment, designed specifically for investigating bioelectric field problems. BioPSE has been developed as part of the NIH-NCRR Center for Bioelectric Field Modeling, Simulation, and Visualization, and will soon be made freely available to the research community.

BioPSE uses a visual dataflow architecture where changes to upstream components (e.g., model parameters) are automatically propagated to downstream components for reevaluation (e.g., simulation and visualization methods). Within BioPSE, we have developed and integrated a novel reciprocity-based source imaging algorithm, as well as a suite of modeling and visualization tools. We will demonstrate the efficiency of performing source localization using BioPSE and, more generally, the power of the interactive interrogation that BioPSE enables.