SIMD Directived Parallelization for a Solver of the Bidomain Equations

Stefan Rosenberger
University of Graz

`stefan.rosenberger@uni-graz.at`

Cardiovascular simulations include coupled PDEs (partial differential equations) for electrical potentials, non-linear deformations and systems of ODEs (ordinary differential equations) all of them are contained in the simulation software CARP (Cardiac Arrhythmia Research Package). We focus in this talk on the solvers for the elliptical part of the bidomain equations describing the electric stimulation of the heart for an anisotropic tissue. The existing conjugate gradient and GMRES solver with an algebraic multigrid preconditioner is already parallelized by MPI+OpenMP/CUDA.

We investigate the OpenACC parallelization of this solver on one GPU especially its competitiveness with respect to the highly optimized CUDA implementation on recent GPUs. The OpenACC performance can achive the CUDA performance if the implementation is especially careful written. Further, we show first results of the GPU parallelizaiton with OpenMP 4.5.