A Space-Time Fast Boundary Element Method for the Heat Equation with Temporal Nearfield Compression

Günther Of[1] Raphael Watschinger[2]

We consider a space-time boundary element method for the solution of initial boundary value problems of the heat equation in three spatial dimensions. In particular we deal with tensor product meshes with adaptive decompositions of the considered time interval and adaptive spatial meshes. We apply a space-time fast multipole method as well as shared and distributed memory parallelization with respect to space and time.

We present a novel temporal nearfield compression technique which enables efficient computations for fine spatial mesh resolutions related to the considered adaptive tensor product meshes. In particular, we introduce a version of the adaptive cross approximation tailored to the nature of the considered heat kernel. Finally, we present numerical experiments that demonstrate the great benefits of the new method for tensor product meshes with spatially fine meshes and adaptive spatial meshes.

[1]Graz University of Technology, Institute of Applied Mathematics, Austria
of@tugraz.at

[2]Graz University of Technology, Institute of Applied Mathematics, Austria
watschinger@math.tugraz.at