RUNGE-KUTTA CONVOLUTION QUADRATURE BASED ON GAUSS METHODS

LEHEL BANJAI AND MATEO FERRARI

Abstract. In this talk, we delve into a discretization technique for time-domain boundary integral operators, Convolution Quadrature (CQ) combined with Galerkin BEM or spatial collocation.

We present an error analysis of Runge-Kutta CQ based on Gauss methods applied to hyperbolic operators. The order of convergence relies heavily on the parity of the number of stages, a more favourable situation arising for the odd cases than the even ones. Moreover, for particular situations the order of convergence is higher than for Radau IIA or Lobatto IIIC methods when using the same number of stages.

We further investigate an application to transient acoustic scattering where, for certain scattering obstacles, the favourable situation occurs in the important case of the exterior Dirichlet-to-Neumann map. Numerical experiments and comparisons show the performance of the method.

Keywords: Runge-Kutta Gauss methods, convolution quadrature, wave equation, Dirichlet-to-Neumann

Mathematics Subject Classifications (2010): 65R20 , 65L06 , 65M15

References

[1] L. Banjai, M. Ferrari. Runge-Kutta convolution quadrature based on Gauss methods. arXiv:2212.07170, 2022.

Maxwell Institute for Mathematical Sciences, Department of Mathematics, Heriot-Watt University Edinburgh, EH14 4AS, United Kingdom
Email address: l.banjai@hw.ac.uk

Dipartimento di Scienze Matematiche G.L. Lagrange Politecnico di Torino, Torino, 10129, Italy
Email address: matteo.ferrari@polito.it