

CRUNCH Seminars at Brown, Division of Applied Mathematics

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Spectral penalty method for the two-sided fractional differential equations with general boundary conditions

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We consider spectral approximations to the conservative form of the two-sided Riemann-Liouville (R-L) and Caputo fractional differential equations (FDEs) with nonhomogeneous Dirichlet (fractional and classical, respectively) and Neumann (fractional) boundary conditions. In particular, we develop a spectral penalty method (SPM) by using the Jacobi poly-fractonomial approximation for the conservative R-L FDEs while using the polynomial approximation for the conservative Caputo FDEs. We present several numerical examples to verify the theory and demonstrate the high accuracy of SPM, both for stationary and time dependent FDEs. Moreover, we compare the results against a Petrov-Galerkin spectral tau method (PGS- τ) and demonstrate the superior accuracy of SPM for all cases considered.