Convolution quadrature for wave propagation problems

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This talk reviews convolution quadrature (as first lectured about in a summer school in Rende, Calabria, in 1986) and its application to boundary integral formulations of problems of wave propagation. A key aspect is the preservation of a positivity property in the framework of an operator-valued version of the classical Herglotz theorem, which apparently cannot be achieved with other kinds of numerical quadrature. This positivity property allows us, in particular, to devise the first provably stable numerical coupling of exterior and interior problems for the wave equation, using FEM-BEM coupling in space and a stabilized coupling of the leapfrog method for time discretization in the interior with convolution quadrature for time discretization on the boundary and in the exterior domain. The talk is based on recent joint work with Lehel Banjai and Francisco Sayas.