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Generalized Weighted Residual Method; Advancements and Current Studies JAN SCHEFFEL, KRISTOFFER LINDVALL, Department of Fusion Plasma Physics, KTH Royal Institute of Technology, Stockholm, Sweden — The *Generalized Weighted Residual Method* (GWRM) is a time-spectral method for solving initial value partial differential equations [1]. The GWRM treats the temporal, spatial, and parameter domains by projecting the residual to a Chebyshev polynomial space, with the variational principle being that the residual is zero. This treatment provides a global semi-analytical solution. However, straightforward global solution is not economical. One remedy is the inclusion of spatial and temporal sub-domains with coupled internal boundary conditions, which decreases memory requirements and introduces sparse matrices. Only the equations pertaining to the boundary conditions need be solved globally, making the method parallelizable in time. Efficient solution of the linearized ideal MHD stability equations of screw-pinch equilibria are proved possible. The GWRM has also been used to solve strongly nonlinear ODEs such as the Lorenz equations (1984), and is capable of competing with finite time difference schemes in terms of both accuracy and efficiency. GWRM solutions of linear and nonlinear model problems of interest for stability and turbulence modelling will be presented, including detailed comparisons with time stepping methods. [1] Scheffel J, AJCM 2(2012)173.

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