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Global magnetohydrodynamic stability with COOL finite elements[1] W. ANTHONY COOPER, RALF GRUBER, Ecole Polytechnique Federale de Lausanne CRPP, Association Euratom-Confederation Suisse, Lausanne, Switzerland — The COOL finite element scheme relies on the construction of basis functions using variable order Legendre polynomials [1]. We have implemented this approach in the global linear ideal magnetohydrodynamic code TERPSICHORE [2]. The standard version of this code uses a hybrid method that combines piecewise constant and piecewise linear basis elements. The COOL method with Legendre polynomial order $p = 1$ exactly recovers the original formulation. So far, we find that the optimal polynomial order lies around $p = 3$ to 4 (cubic to quartic). At higher order, numerical problems develop in the regions within half-interval mesh points of the magnetic axis and the edge of the plasma because extrapolation of poorly resolved equilibrium quantities at the Gauss-points of the Legendre polynomial can drive very local fictitious near-axis and/or edge mode structures.

[1] A. Ahusborde, R. Gruber, M. Azaiez, M. L. Sawley, Phys. Rev. E **75** (2007) 056704.
[2] D. V. Anderson, W. A. Cooper, R. Gruber, S. Merazzi, U. Schwenn, Int. J. Supercomp. Appl. **4** (1990) 34-47.

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