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Free-boundary MRxMHD equilibrium calculations using the stepped-pressure equilibrium code STUART HUDSON, Princeton Plasma Physics Laboratory, JOAQUIM LOIZU, Ecole Polytechnique Federale de Lausanne, Swiss Plasma Center, CH-1015 Lausanne, Switzerland, CAOXIANG ZHU, Princeton Plasma Physics Laboratory, ZHISONG QU, Mathematical Sciences Institute, the Australian National University, Canberra ACT 2601, Australia, CAROLIN NUEHRENBERG, SAM LAZERSON, Max-Planck-Institut für Plasmaphysik, 17491 Greifswald, Germany, CHRIS SMIET, Princeton Plasma Physics Laboratory, MATTHEW HOLE, Mathematical Sciences Institute, the Australian National University, Canberra ACT 2601, Australia — The stepped-pressure equilibrium code (SPEC) (Hudson et al. 2012 Phys. Plasmas 19, 112 502) is extended to enable free-boundary multi-region relaxed magnetohydrodynamic (MRxMHD) equilibrium calculations. The vacuum field surrounding the plasma inside an arbitrary computational boundary, D , is computed, and the virtual-casing principle is used iteratively to compute the normal field on D so that the equilibrium is consistent with an externally produced magnetic field. Recent modifications to SPEC are described, such as the use of Chebyshev polynomials to describe the radial dependence of the magnetic vector potential, and a variety of free-boundary verification calculations are presented.

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