

Abstract Submitted  
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**Extending M3D- $C^1$  to stellarator geometry: preliminary results<sup>1</sup>**

YAO ZHOU, N. M. FERRARO, S. C. JARDIN, Princeton Plasma Physics Laboratory, H. R. STRAUSS, HRS Fusion — Stellarator plasmas have been observed to be nonlinearly stable even when driven beyond linear MHD stability thresholds. Hence, stellarator designs could employ nonlinear stability considerations to relax linear stability constraints, which can often be too restrictive and costly. However, this possibility has not been systematically investigated due to the lack of a state-of-the-art nonlinear initial-value MHD code for stellarators. We aim to fill this gap by extending the M3D- $C^1$  code from tokamak to stellarator geometry. Our approach introduces a set of logical coordinates, in which the computational domain is axisymmetric, to utilize the existing finite-element framework. The mapping between the logical and the physical  $(R, \phi, Z)$  coordinates is then used to calculate derivatives in the latter, in terms of which the existing physics equations are written. This way, no significant changes to the extended-MHD models within M3D- $C^1$  are required. So far, we have successfully implemented this approach in 2D and verified its results against the existing code. Preliminary results from 3D implementation will also be presented and discussed.

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