

Abstract Submitted  
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**Near-Axis Framework for the Construction of Analytical Stellarator Equilibria**<sup>1</sup> ROGERIO JORGE, University of Maryland, College Park, WRICK SENGUPTA, Courant Institute of Mathematical Sciences, New York University, MATT LANDREMAN, PATRICK KIM, University of Maryland, College Park — A direct construction of analytical MHD equilibrium using an expansion in the powers of the distance to the magnetic axis is carried out. The approach developed here makes use of a set of orthogonal coordinates related to the geometry of the axis first derived by Mercier [1]. This reduces the MHD system of equations from a three-dimensional to a one-dimensional one, allowing us to considerably reduce its computational cost and gain greater physical insight into the nature of the magnetic field, even in the presence of chaotic magnetic field lines. The near-axis framework was recently generalized to arbitrary order in Ref. [2], where the analytical forms of the magnetic field, toroidal flux and rotational transform were derived and a numerical solution using a W7-X equilibrium was presented. In here, we focus on new developments using the near-axis approach, such as the construction of first and second order quasisymmetric stellarator shapes [3] and their linear gyrokinetic stability properties. [1] C. Mercier, 1964, Nucl. Fusion 4 (3), 213 [2] R. Jorge, W. Sengupta, M. Landreman, Journal of Plasma Physics 86 (1), 905860106 (2020) [3] R. Jorge, W. Sengupta, M. Landreman, Nuclear Fusion 60 (7), 076021 (2020)

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Rogério Manuel Cabete de Jesus Jorge  
University of Maryland, College Park

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