PROPERTIES OF HIGH β, QUASI-AXISYMMETRIC NCSX STELLARATOR CONFIGURATIONS

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A class of quasi-axisymmetric stellarator configurations, which rely on the plasma current to generate a portion of the rotational transform, has recently been developed as part of the NCSX design efforts. These configurations, typically with an aspect ratio of 3.5, have monotonically increasing iota profiles, are stable to ideal MHD modes (vertical, kink, and ballooning) to β~4%, and possess good quasi-axisymmetry (with the largest component in the magnetic field spectrum < 0.7% at r/a=0.7). The process by which we arrive at these configurations and the general features of these configurations have been discussed in a number of papers (e.g. A. Reiman, et al. in *Proceedings of the 26th European Physical Society Conference on Controlled Fusion and Plasma Physics Research*, Maastricht, the Netherlands, June 14-18, 1999). In this paper, we elaborate further on some of the properties important to understand the flexibility and sensitivity of this class of configurations. We discuss how the Fourier components that describe the plasma boundary play the role, individually and collectively, in stabilizing the kink modes and in achieving the quasi-axisymmetry. By ordering the boundary components, we show that a small set of coefficients with moderate magnitudes and low toroidal and poloidal mode numbers are particularly effective in reducing the magnitude of the non-axisymmetric Fourier components of the magnetic field spectrum, at least for the configuration that is of primary interest, i. e. QAS3_C82, the NCSX reference configuration. In addition, we discuss the sensitivity of the configurations to the pressure and current profiles. We show a newly developed, more robust configuration that takes advantage of the stable gap for the kink modes at an edge iota just below 0.5.

* This work was supported by United States Department of Energy Contract No. DE-AC02-76-CHO-3073