§3. Comparison of the MHD Stability Analyses between the CAS3D and the RESORM Codes

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In the MHD stability analysis for the heliotron/torsatron configurations, the two dimensional methods have been extensively used. The RESORM code[1] used here is one of such a 2D code, which is based on the 3-field reduced MHD equations with the modified stellarator expansion method. This code has been modified so that it can analyze the stability of the 3D equilibrium obtained with the VMEC[2] code. Recently, three dimensional ideal MHD stability code called CAS3D was developed by Schwab[3] which solves an eigenvalue problem based on the energy principle of the ideal MHD equations. We have examined how effective the approximation used in the 2D stability code is by comparing the results of the both codes.

A heliotron/torsatron configuration with 10 field periods is used for the comparison. The currentless equilibria with a broad pressure profile are calculated under the fixed boundary condition. From the Mercier unstable region as shown in Fig.1, the m=5/n=3 mode seems to be more unstable. Hence, in the calculation with the CAS3D code, we have chosen 35 fourier modes in the family of n=3 for the perturbation. Since we can specify the toroidal mode number in the two dimensional calculation, the n=3 is employed in the calculation with the RESORM code. We obtained that the interchange mode is the most unstable instability in the equilibria for both codes. Fig.2 shows the growth rates of the mode. Good agreements are seen between them, and the averaged beta limit by the instability is about 1%. The mode structures are also very similar to each other and the m=5/n=3 mode is dominant, which is consistent with the expectation from the Mercier criterion. From this result, we consider that the two dimensional approximation based on the reduced equations may be valid for the analysis of the interchange mode in a configuration with 10 field period.

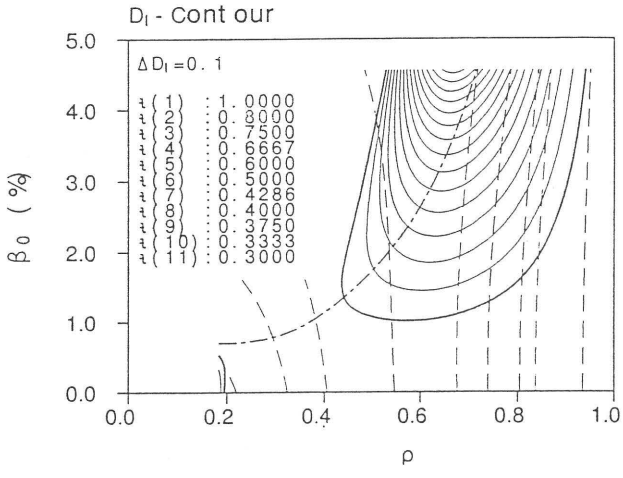

Fig.1 Mercier unstable region in a torsatron/heliotron plasma.

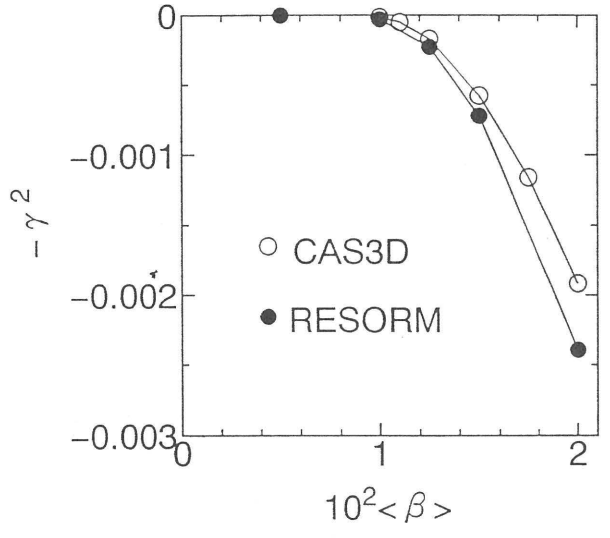

Fig.2 Growth rates obtained by the CAS3D code (open circle) and the RESORM code (closed circle).

References
1) Ichiguchi K., et al. : Nucl.Fusion 31 (1991) 2073.
2) Hishman S.P., et al. : Comp.Phys.Comm. 43 (1986) 143.
3) Schwab.C., : Phys.Fluids B5 (1993) 3195.