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Numerical Analysis of Parametric Instability in Lower Hybrid Current Drive in Tokamak

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Parametric instability is generally considered to be one of the main reasons for the current drive efficiency anomalous decrease of lower hybrid waves in high density plasmas.[1] The quantitative calculation of parametric instability and detailed analysis based on it are of great significance for the improvement of lower hybrid wave current drive. In recent work, an improved code-Plasma Parametric Instability Calculation (PPIC) with the optimized numerical methods has been developed, and several basic properties of lower hybrid wave parametric instability has been concluded.

The mathematical structure of parametric instability equations based on electrostatic models is studied and the inherent double-pit structure is revealed. Furthermore, the objective function based on this structure is improved, which greatly improves the stability and speed of parametric channel solving and growth rate calculation. On the basis of the improved algorithm, the influence of the angle between the sideband and the pump wave vector, and the magnetic field direction component of the sideband on the parametric instability process are studied. Finally, it is found that these two parameters have significant influences on the channels, but have a limited influence on the level of growth rate. These two parameters affect the nonlocal behavior of the parametric instability process mainly by the convection loss caused by the inhomogeneity.

References

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[2] R. Cesario *et al*, Nucl. Fusion **46** 4 (2006)

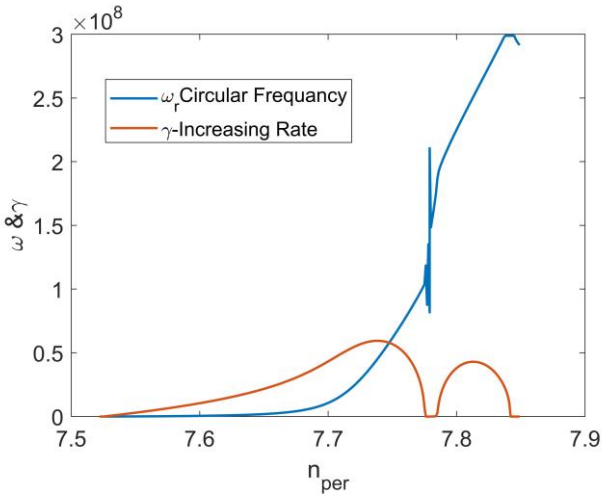

Figure 1. The dispersion relation and growth rate diagram of parametric instability under a set of experimental parameters on JET[2], which is solved by PPIC. The red curve refers to the growth rate and the blue curve refers to the wave frequency. The maximum point of the growth rate curve and its adjacent region are generally considered to be the main channels of parametric instability processes.