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LHDにおける外部磁場摂動の真空近似モデリング
Vacuum model of external magnetic perturbation in LHD

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In tokamaks, high confinement mode (H-mode) is necessary for the fusion reactor. However, in the H-mode, the edge localized modes (ELMs) as an instability appears. The ELM is danger to the wall integrity shorten the life time of plasma facing components and it reduces the plasma performance. Large type-I ELMs were completely suppressed at the DIII-D tokamak by small edge resonant magnetic perturbation (RMP) fields. As this technique is the only one which successfully demonstrated the potential to control the type-I ELMs, RMP coils are designed for many tokamaks.

On the other hand, in the Large Helical Device (LHD), external coils to produce magnetic island in vacuum flux surfaces are installed. These coils were designed to the island divertor configuration, so-called the LID (Local Island Divertor) coil. Recently, these coils applied to experiments of the island dynamics or interactions between MHD stabilities and magnetic island. This means the LID coil is the RMP coil in the LHD. Usually, the LID coil is used to produce low-n magnetic islands, for an example, m/n=1/1 island.

Up to now, the width of magnetic islands produced by the LID coils was not estimated by the normal component of perturbed field but it was estimated by the puncture plot of magnetic field lines. Althogh the estimation from the puncture plot has a problem of the accuracy, it was used. One reason why we did not caluclate the normal component of the preturbed field is a difficulties to define a reference surface on the magnetic island. In this study, we estimate the width of the magnetic island from normal components of perturbed fields. To calculate normal components of perturbed fields, we use the 'Chaotic coordinate'. The Chaotic coordinate is a quasi flux coordinate system, which can be used on the magnetic island and stochastic field lines. Using the Chaoctic coordinate, we can calculate the Fourier transformation on the magnetic island. Thus, we can estimate accurately the width of the magnetic island.