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## On the Circulating Current Control of a LCL Converter for Tokamak

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**Abstract**—This paper suggests a four quadrants converter System for tokamak CPSS, such as ITER-like CFETR. The converter is composed of insulated-gate bipolar transistor (IGBT) and an internal passive LCL circuit. The resonant frequency characteristics of the LCL circuit are analyzed, and a parameter design method on the base of voltage stepping and the current regulation under extreme external dc faults is also presented. a control method for circulating current control is proposed. The salient features of the proposed converter System are 1) the circulating current can be controlled in such a way that it never become zero, and load current can change polarity without any discontinuity and dead zone, even if in the case that the total reference voltage of converter changes rapidly; 2)A transformer is not required since LCL circuit can achieve voltage stepping; 3) fault current of the converters with LCL transformer will be close to or below the rated value in the short circuit fault conditions occurring in AC or DC sides; 4) the converter is controlled by PWM, the reactive power can be absorbed by the grid. The effectiveness of the proposed four quadrants converter System is substantially confirmed by the simulation.

**Index Terms**—LCL ; four quadrants ; fault-current; circulating current; CFETR

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