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Cut-off Probe Frequency Spectrum의 물리적 해석

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Although the cut-off probe, a precise measurement method for the electron density, is widely used in the industry, the physics on the wave spectrum of the cut-off is not understood yet, only cut-off point frequency containing the information of electron density has been analyzed well. This paper analyzes the microwave frequency spectrum of the cut-off probe to see the physics behind using both microwave field simulation (CST Microwave Studio) and simplified circuit simulation. The result shows that the circuit model well reproduces the cut-off wave spectrum especially in the low frequency regime where the wavelength of the driving frequency is larger than the characteristic length and reveals the physics of transmission characteristics with frequency as resonances between vacuum, plasma and sheath. Furthermore, by controlling the time domain in solver of the microwave simulator, the cut-off like transmission peaks above the cut-off frequency which has been believed as cavity effect is verified as chamber geometry effect. The result of this paper can be used as the basis for the improvement of cut-off probe.

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