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Electrostatic and Electromagnetic Resonances of the Curling probe ALI ARSHADI, Institute for Theoretical Electrical Engineering, Ruhr University Bochum, Germany, LEILA VALADBEIGI, Power Systems Technology and Power Mechatronics, Ruhr University Bochum, Germany, RALF PETER BRINKMANN, Institute for Theoretical Electrical Engineering, Ruhr University Bochum, Germany — The term Active Plasma Resonance Spectroscopy denotes a class of plasma diagnostic techniques utilizing the natural ability of plasma to resonate on or near the electron plasma frequency: An electric signal in the GHz range is coupled into the plasma via a probe. The spectral response of the plasma is recorded and a mathematical model is used to find plasma parameters such as the electron density. The curling probe, recently invented by Liang et al., is a novel realization of this concept which has many practical advantages. In particular, it can be miniaturized, and flatly embedded into the chamber wall, enabling monitoring of plasma processes without perturbing them. Physically, the curling probe can be seen as a "curled" form of the hairpin probe. Assuming that the effect of the spiralization is negligible, this work investigates the features of a "straightened" curling probe by modeling it as a slot-type resonator which is in contact with the plasma. The diffraction of an incident plane wave at the slot is calculated by solving Maxwell's equations and the cold plasma model simultaneously. Electrostatic and Electromagnetic resonances are derived. Good agreement of the analytically computed resonance frequencies with the numerical results of the probe inventors is shown.

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