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Analytical Study of the Curling Probe: Resonance Frequencies
ALI ARSHADI, RALF PETER BRINKMANN, Department for Electrical Engineering and Information Sciences, Ruhr University Bochum — The term "active resonance spectroscopy" refers to a class of plasma diagnostic techniques which utilizes the ability of plasmas to resonate on or near to the electron plasma frequency. The curling probe is a newly developed variant which may be called an optimized (in particular: miniaturized)hair pin probe [1, 2]. The device can be mounted coplanar in the discharge chamber wall where it practically causes no perturbation of the plasma. Like the hair pin probe, it is resonant with a frequency f_0 under vacuum conditions, but experiences a frequency shift in the presence of plasma. However, no reliable analysis exists which relates the magnitude of this shift to the absolute value of the plasma density. In this contribution, we will fill this gap. We first derive a formula for the phase velocity of an electromagnetic wave which propagates along a slit in a thin, perfectly conducting screen located between to dielectrics, and then show how this result can be used to describe the resonance frequencies of the curling probe.

[1] R. B. Piejak *et. al.*: J. Appl. Phys. 95 (2004) 3785.
[2] I. Liang *et. al.*: Appl. Phys. Express 4 (2011) 066101.

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