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Resonance Frequencies of Curling Probe in Plasma: Surface Wave Analysis ALI ARSHADI, RALF PETER BRINKMANN, Department for Electrical Engineering and Information Sciences, Ruhr University Bochum — Electron density is a crucial characteristic in reactive plasma sources determining the quality of material processing like etching. A recently invented plasma diagnostic probe called curling probe resonates in distinctive frequencies when it is embedded in the wall of the plasma reactor. The excited frequencies are studied for various electron densities. It has been demonstrated that the high-frequency (HF) volume wave resonances and the low-frequency (LF) surface wave (SW) resonances are predictable considering the wave propagation in plasma when it is diffracted on the curling probe. We consider the three dimensional diffraction of incident plane wave by a slot in an infinitely thin perfectly conducting screen located between dielectric and sheath. Our computations for LF resonances were published recently. The results are in a very good agreement with the FDTD analysis. Here it is demonstrated that the LF resonances are based on the SW propagation. We compare our result with the one comes from SW analysis and we prove that the LF resonances are not dependent on the length of probe. We generalized our study to be able to investigate the effect of sheath thickness and electron-neutral collisions which is not possible in the other theoretical and computational methods.

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