Abstract Submitted
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Analytic Model for Self-Excited Plasma Series Resonances[1] UWE CZARNETZKI, Institute for Plasma and Atomic Physics, Ruhr University Bochum, THOMAS MUSSENBROCK, RALF-PETER BRINKMANN, Institute for Theoretical Electrical Engineering, Ruhr University Bochum — Self-excited Plasma Series Resonances (PSR) are observed in capacitve discharges as high frequency oscillations superimposed on the normal RF current. This high-frequency contribution to the current is generated by a series resonance between the capacitve sheath and the inductive and ohmic bulk of the plasma. The non-linearity of the sheath leads to a complex dynamic. The effect is applied e.g. as a diagnostic technique in commercial etch reactors where analysis is performed by a numerical model. Here a simple analytical investigation is introduced. In order to solve the non-linear equations analytically, a series of approximation is necessary. Nevertheless, the basic physics is conserved and excellent agreement with numerical solutions is found. The model provides explicit and simple formula for the current waveform and the spectral range of the oscillations. In particular, the dependence on the discharge parameters is shown. Further, the model gives insight into an additional dissipation channel opened by the high frequency oscillations. With decreasing pressure the ohmic resistance of the bulk is decreasing too, while the amplitude of the PSR oscillations is growing. This results in substantially higher power dissipation.

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