Abstract Submitted
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Nonlinear electromagnetics model of an asymmetrically driven capacitive discharge[1] M.A. LIEBERMAN, EMI KAWAMURA, A.J. LICHTENBERG, University of California, Berkeley, DE-QI WEN, Dalian University of Technology, Dalian, China — It is well-known that standing waves exist in high frequency driven capacitive discharges and that capacitive sheaths can nonlinearly excite driving frequency harmonics near the series resonance that can be spatially near-resonant. The powered-electrode/plasma/grounded-electrode structure of an asymmetrically excited cylindrical discharge forms a three electrode system in which both z-symmetric and z-antisymmetric radially propagating wave modes exist. We develop a nonlinear electromagnetics model with radially- and time-varying sheath widths, incorporating both modes and plasma skin effects. The discharge is modeled as a uniform density bulk plasma with homogeneous or Child law sheaths at the electrodes, incorporating their nonlinear voltage versus charge relations. The model includes a finite power source resistance and a self-consistent calculation of the dc bias voltages. The resulting set of nonlinear partial differential equations is solved numerically to determine the symmetric and antisymmetric mode amplitudes and the nonlinearly-excited radially-varying harmonics of the two modes. Results are given for a 60 MHz, 10 mTorr chlorine discharge in a 50 cm diameter, 5 cm height chamber with a 30 cm diameter powered electrode.

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