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The collisional capacitive RF sheath and the assumption of a sharp electron edge[1] RALF PETER BRINKMANN, Ruhr University Bochum, Theoretical Electrical Engineering — The transition from quasi-neutrality to charge depletion is one of the characteristic features of the plasma boundary sheath. It is often described in terms of the so-called step model which assumes a transition point (electron step) where the electron density drops from a value equal to the ion density (in the bulk) to a value of zero (in the sheath). Inserted into Poisson's equation, the step model yields an expression for the field which is realistic deep in the sheath but fails to merge correctly into the ambipolar field of the bulk. This work studies the consequences of that approximation for the example of the collision-dominated, capacitive RF sheath by Lieberman [1]. First, the model is solved exactly, using a relaxation scheme. Then, the step approximation is applied which recovers Lieberman's semi-analytical solution. It is demonstrated that the step approximation induces a spurious divergence of the ion density at the sheath edge and prevents a matching of the sheath model to a bulk model. Integral sheath quantities, on the other hand, like the capacitance or the overall voltage drop, are faithfully reproduced. [1] M. A. Lieberman, IEEE Trans. Plasma Sci. 16, pp. 638-644 (1988).

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