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An analytical model for floating probes in AC plasma and its application to double probes for high density, high power RF discharges JUAN FRANCISCO CANESES, BOYD BLACKWELL, Australian National University, PLASMA RESEARCH LABORATORY TEAM — In this work we provide an analytical model that allows one to quantitatively assess the RF compensation performance and suitability of the double probe technique for use in RF generated plasma. The model is based in the theory of the self-bias effect as described in Braithwaite's work, which we extend to include the time resolved behavior of floating probes. We provide experimental verification for this model and show that the theory of transient RF self-bias probes and harmonic current detection probes are limiting cases of this extended model. Furthermore, the model shows that the RF compensation is solely dependent on the sheath impedance, the probe's stray capacitance to ground and RF frequency. In addition, we use these results to implement a double probe system for use in high density helicon plasma where heat loads could potentially damage the intricate components in an RF compensating circuit. Finally we use this model to (1) recommend ways to extend the operational regime of double probes where the plasma conditions would render them unsuitable and to (2) comment on the use of this model to aid design of RF compensated Langmuir probes.

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