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A control-oriented self-consistent model of an inductively-coupled plasma BERNARD KEVILLE, MILES TURNER, NCPST, Dublin City University, PRECISION STRATEGIC RESEARCH CLUSTER TEAM — An essential first step in the design of real time control algorithms for plasma processes is to determine dynamical relationships between actuator quantities such as gas flow rate set points and plasma states such electron density. An ideal first principles-based, control-oriented model should exhibit the simplicity and computational requirements of an empirical model and, in addition, despite sacrificing first principles detail, capture enough of the essential physics and chemistry of the process in order to provide reasonably accurate qualitative predictions. This presentation describes a control-oriented model of a cylindrical low pressure planar inductive discharge with a stove top antenna. The model consists of equivalent circuit coupled to a global model of the plasma chemistry to produce a self-consistent zero-dimensional model of the discharge. The non-local plasma conductivity and the fields in the plasma are determined from the wave equation and the two-term solution of the Boltzmann equation. Expressions for the antenna impedance and the parameters of the transformer equivalent circuit in terms of the isotropic electron distribution and the geometry of the chamber are presented.

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