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Plasma Modeling of Electrosurgery SCOTT JENSEN, DANIEL FRIEDRICHS, JAMES GILBERT, WOUNJHANG PARK, DRAGAN MAKSIMOVIC, University of Colorado-Boulder — Electrosurgery is the use of high frequency alternating current (AC) to illicit a clinical response in tissue, such as cutting or cauterization. Power electronics converters have been demonstrated to generate the necessary output voltage and current for electrosurgery. The design goal of the converter is to regulate output power while supplying high frequency AC. The design is complicated by fast current and voltage transients that occur when the current travels through air in the form of an arc. To assist in designing a converter that maintains the desired output power during these transients, we have used the COMSOL Plasma Module to determine the output voltage and current characteristics during an arc. This plasma model, used in conjunction with linear circuit elements, allows the full electrosurgical system to be validated. Two models have been tested with the COMSOL Plasma Module. One is a four-species, four-reaction model based on the local field approximation technique. The second simulates the underlying air chemistry using 30 species, 151 chemical reactions, and a coupled electron energy distribution function. Experimental output voltage and current samples have been collected and compared to both models.

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