INVESTIGATION OF SWITCH DESIGNS FOR A PROLATE-SPHEROIDAL IMPULSE RADIATING ANTENNA

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The prolate-spheroidal impulse radiating antenna (PSIRA) is used to focus a fast (100 ps), high voltage (> 100 kV) pulse launched from the first focal point onto targets located at the second focal point. These fast electromagnetic pulses with high amplitude are used in various biological applications such as skin cancer treatment and gene insertion. For these fast, high voltage pulses a switch system is desired to radiate spherical TEM waves from the first focal point. The switch system consists of the switch cones, gas (hydrogen) chamber and the pressure vessel.

We have investigated various switch cone geometries which deviate from previous designs used in the prototype IRA system. Impedance considerations play an important role in the design of such a switch system. The use of 100 ps pulses also presents the interesting possibility of reducing the feed arms from the PSIRA. The waves radiated from the switch/source and the focal impulse waveforms for each design are explored using numerical simulations.

The hydrogen chamber and pressure vessel are required to avoid dielectric breakdown when the switch is subjected to input voltages of greater than 100 kV. The design of the pressure vessel involves optimizing the dimensions and determining suitable dielectric material so that a spherical TEM wave emanates from the first focal point. The design must also be easy to fabricate. Numerical simulations to investigate the pressure vessel design are presented in this paper. The possibility of using the pressure vessel as a lens is also explored.