MECHANICAL AND AEROSPACE ENGINEERING DEPARTMENT SEMINAR

Thursday, March 16, 4:00 PM, BR1402
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TITLE: Numerical modeling of external *in vivo* plate electroporation thermal dose assessment: skin composite model and aggressive cooling

Electroporation is an approach used to enhance the transport of large molecules to the cell cytosol in which a targeted tissue region is exposed to a series of electric pulses. The cell membrane, which normally acts as a barrier to large molecule transport into the cell interior, is temporarily destabilized due to the development of pores in the cell membrane. Consequently agents that are ordinarily unable enter the cell are able to pass through the cell membrane. Of possible concern when exposing biological tissue to an electric field is thermal tissue damage associated with joule heating. The purpose of this paper is twofold. First a model of external plate electroporation is developed that models the composite layers of the skin and subcutaneous tissue layer. This paper shows the importance of using a composite model in calculating the electrical and thermal effects associated with skin electroporation. A three-dimensional transient finite-volume model of *in vivo* skin electroporation is developed to emphasize the importance of representing the skin's composite layers and to illustrate the underlying relationships between the physical parameters of the composite makeup of the skin and resulting thermal damage potential. Finally this paper introduces a theoretical aggressive pre-cooling technique which is shown to greatly reduce the risk of thermal damage.