CPS: Medium: Autonomous Attainment of Tissue-Centricity in Electrosurgery through Data-Driven Persistently Evolving Thermogeometric Adaptivity

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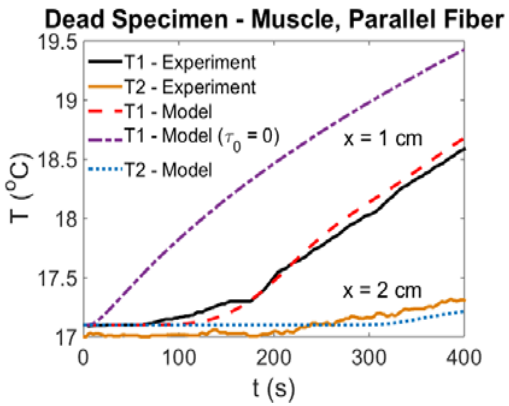
Description

Electrosurgical action must be tissue-friendly, while also providing to the surgeon the safe operating envelope

Goals of This Project :

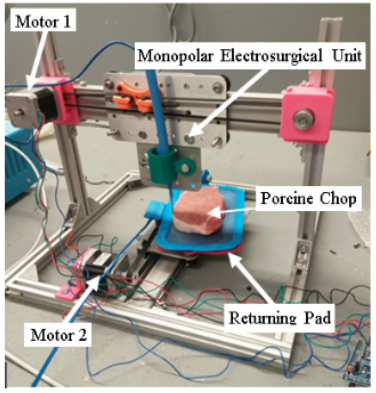
- Introduce formal models of electrosurgical instrument interacting with live tissue via controlled experiments
- Develop safe and human-understandable autonomous electrosurgical systems
- Enable tissue-surgeon real-time information flow to improve performance

Key features and impact



Nonlinear PDE
Telegraph Equation

$$c(T)\rho(T)\frac{\partial}{\partial t}T+\tau_0(T)\frac{\partial}{\partial t}\left(c(T)\rho(T)\frac{\partial}{\partial t}T\right)$$
$$=\nabla k(T)\nabla T+k(T)\nabla^2 T.$$



Findings

- Designed and conducted *in vivo* studies of electrosurgical probe interaction with live tissue
- Equations of heat propagation in live tissue have been initially developed
- Proposed safe sensing and control configurations that reduce tissue damage
- Electrosurgical action was found to induce the hypersonic-type heat shock wave with respect to the tissue