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Bradley E Treeby* (bradley.treeby@anu.edu.au), Research School of Engineering, The Australian National University, Canberra, ACT 0200, Australia. *Large-scale modeling of nonlinear ultrasound waves in tissue.*

High-intensity focused ultrasound is a noninvasive therapy in which an ultrasound probe positioned outside the body is used to deliver acoustic energy to a target volume inside the body. The treatment planning challenge is to deliver enough energy to coagulate the tissue within this volume, while leaving the surrounding areas unharmed. This equates to solving an optimization problem using coupled acoustic and thermal equations. The acoustic part is complicated by the fact the tissue is heterogeneous, the wave propagation is nonlinear, and the domain size can be on the order of thousands of wavelengths. This talk will focus on recent work to develop large scale nonlinear ultrasound models based on the Fourier collocation pseudospectral method. First, the governing equations are derived, cognizant of the chosen numerical method. For example, power law acoustic absorption is modeled using a linear integrodifferential operator based on the fractional Laplacian. Next, the discretization is discussed, including the use of a dispersion correction term derived from an analytical solution of the prototypical equation. Finally, results from simulations with grid sizes up to 2048^3 are presented, and the computational challenges and applications to treatment planning are discussed. (Received September 10, 2012)