Numerical modeling of non-Fourier thermal damage with time-dependent

laser heat source

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Abstract

It is important to enhance the understanding and accurately assessing heat laser-induced thermal conduction and thermal damage to biological tissues. In order for ensuring the personal safety and accuracy of treatment efficiency in medical applications, in the present paper, the Cattaneo-Vernotte model for non-Fourier heat conduction subjected to laser heat source is present and simulated by Discontinuous Galerkin Finite Element Method (DGFEM). The simulated results exhibit the accuracy and consistency with the comparison to the analytical solutions. Furthermore, thermal damage process is combined with non-Fourier heat conduction to show the influence of damage parameter assessed with the variation of thermal relaxation time. It is indicated that the thermal damage is significantly different compared to that of the classical heat conductive model.

Keywords: non-Fourier effect, thermal damage, DGFEM, numerical modeling, laser pulse source