

**SENSITIVITY ANALYSIS AND RETRIEVAL OF INCLUSION PROPERTIES IN PARTICIPATING MEDIA BASED ON THE SHORT PULSE LASER INCIDENCE****D. L. Wang, Hong Qi, Biao Zhang, Xing Sun and L. M. Ruan**School of Energy Science and Engineering, Harbin Institute of Technology  
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**ABSTRACT.** The Transient Radiative Transfer Equation (TRTE) was used to describe the transmission of the short pulse laser in the two-dimensional (2-D) participating media. The Finite Volume Method (FVM) was applied to solve the TRTE, which was validated by comparing with the Discrete Ordinate Method (DOM) and the Least Square Finite Element Method (LS-FEM). Then, the Local Incidence (LI) and Non-Local Incidence (NLI), two incident types on the surface of media, were proposed. Time-domain thermal signals, which are the ratios of radiative heat fluxes on the boundary to incident laser heat flux, were simulated, and the results of time-domain thermal signals with two incident types, i.e. LI and NLI, were compared. In addition, inhomogeneous media consisting of circle inclusions were investigated and the influences of inclusion location were studied. Moreover, sensitivity analysis of inclusion location and size for different thermal signals has been done, and the sensitive spans of signals were found. Finally, inverse problems for inhomogeneous media with the known inclusion shape of a circle have been analyzed by using stochastic particle swarm optimization (SPSO). It could be concluded that optical properties (scattering and absorption coefficients) and locations of the inclusion were estimated correctly based on the thermal signals by using the SPSO algorithm.

Key words: short pulse laser; time-domain radiative signals; inverse problems; SPSO