

A method to measure heating rate for heat flux estimation

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A new method for estimating heat fluxes from heating rate measurements and an approach to measure heating rates is proposed. Heating rate is defined as the time rate of change of the temperature. The example problem involves analytic heat conduction in a one-dimensional slab, where the measurement location coincides with the location of the estimated heat flux. The new method involves the solution to a Volterra equation of the second kind, which is inherently more stable than Volterra equations of the first kind. The estimates of the new approach are compared to typical inverse solution methods. The heating rate measurements are accomplished by leveraging the temperature dependent decay rate of thermographic phosphors. Results indicate that the new data-reduction method is far more stable than minimizing temperature residuals with errors of the order of the measurement noise.