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THEORETICAL-EXPERIMENTAL ANALYSIS OF HEAT TRANSFER IN NANOCOMPOSITES VIA INTEGRAL TRANSFORMS AND INFRARED THERMOGRAPHY

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SUMMARY: Theoretical and experimental methodologies for the identification of spatially variable thermophysical properties are illustrated by using samples of nanocomposites of alumina oxide nanoparticles dispersed in a polymeric matrix. First the heterogeneous nanocomposite plate is thermally characterized by means of a fairly simple experimental setup which can be modeled by a one-dimensional heat conduction formulation with space variable properties. Temperature measurements are obtained via infrared thermography, the direct problem is handled by an error-controlled integral transform solution, and the inverse analysis is undertaken via Bayesian inference (MCMC method). Then, in order to illustrate a practical application of the methodologies here presented, we also show some results in which a small electrical resistance is attached to the plate, simulating an electronic device installed on the nanocomposite substrate, which in such situation works as a heat spreader modeled by a two-dimensional heat conduction formulation.