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A MONTE CARLO RANDOM WALK-BASED METHODOLOGY FOR CALCULATION OF SENSITIVITY COEFFICIENTS IN INVERSE RADIANT BOUNDARY DESIGN PROBLEM

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ABSTRACT. This study presents a methodology for the solution of inverse boundary design problems involving transient heat conduction in solid objects imposed by radiant boundary condition. The inverse solution aims to find the required time-varying radiant wall temperature that provides the desired temperature histories at several selected design points inside the solid objects. Gradient-based optimization approach is employed, and a novel methodology is developed for the calculation of the sensitivity coefficients. The sensitivity coefficients are compared with the reference solution obtained from finite difference approximation. First, the inverse boundary design methodology was tested on two scenarios with known radiant wall temperature profiles. Using the true solutions of the problems, the validity of the developed methodology was verified. Next, the methodology was tested on a case where a constant cooling rate at a single design point was set as objective function. Results show that the methodology can successfully determine the required radiant wall temperature profile that fulfills the desired cooling rate.

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