

Inverse Heat Conduction Analysis of Cooling on Run-Out Tables

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Abstract : In this paper, we introduced a gradient-based inverse solver to obtain the missing boundary conditions based on the readings of internal thermocouples. The results show that the method is very sensitive to measurement errors, and becomes unstable when small time steps are used. The artificial neural networks are shown to be capable of capturing the whole thermal history on the run-out table, but are not very effective in restoring the detailed behavior of the boundary conditions. Also, they behave poorly in nonlinear cases and where the boundary condition profile is different. GA and PSO are more effective in finding a detailed representation of the time-varying boundary conditions, as well as in nonlinear cases. However, their convergence takes longer. A variation of the basic PSO, called CRPSO, showed the best performance among the three versions. Also, PSO proved to be effective in handling noisy data, especially when its performance parameters were tuned. An increase in the self-confidence parameter was also found to be effective, as it increased the global search capabilities of the algorithm. RPSO was the most effective variation in dealing with noise, closely followed by CRPSO. The latter variation is recommended for inverse heat conduction problems, as it combines the efficiency and effectiveness required by these problems.

Keywords : inverse analysis, function specification, neural net works, particle swarm, run-out table

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