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SYNERGESTIC APPROACH FOR THE SIMULTANEOUS ESTIMATION OF HEAT TRANSFER COEFFICIENT AND HEAT FLUX USING FIN FROM STEADY STATE HEAT TRANSFER EXPERIMENTS

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ABSTRACT This paper reports simultaneous estimation of heat transfer coefficient and heat flux from natural convection fin heat transfer. The experimental setup contains rectangular mild steel fin of dimensions (250×154×6 mm) and an aluminium base plate of dimensions (250×150×8 mm). A slot of 4mm depth is created at the center of aluminium plate along its length (250mm) and mild steel fin is press fitted into this slot. Eighteen calibrated K-type thermocouples are used to record the temperature of the base plate and the fin. Beneath the base plate, a heater is placed with the dimensions of the base plate. To restrict the heat loss, bottom and sides of the heater are insulated with glass wool. Steady state experiments are carried out for different heat input. The problem considered is an inverse problem where in heat transfer coefficient and heat flux can be estimated simultaneously for the given temperature data from experiments/surrogate data. The forward model uses Asymptotic Computational Fluid Dynamics (ACFD) to obtain temperature distribution for the assumed inputs (heat transfer coefficient and heat flux). A powerful Markov Chain Monte Carlo method along with Metropolis-Hastings algorithm is used to minimize the objective function. Finally, the estimated values of heat transfer coefficient and heat flux are reported in terms of mean.

Keywords: ACFD, Markov Chain Monte Carlo, Metropolis-Hastings algorithm, heat transfer coefficient, heat flux, mean.