

# **INVERSE BOUNDARY DESIGN OF A SQUARE ENCLOSURE WITH FREE CONVECTION AND RADIATION**

S. Payan, S. M. H. Sarvari  
Mechanical Engineering Department  
The University of Sistan & Baluchestan, 98135-161, Zahedan, Iran

**ABSTRACT.** This paper considers an inverse boundary design problem in a square cavity with combined radiation and free convection heat transfer. The aim of design is to obtain the temperature distribution over the heater surface located on the bottom wall of the square cavity for reconstruction a uniform heat flux distribution over the temperature-specified design surface located on top wall of the cavity. The solution of problem includes three parts; the direct problem, the inverse problem, and the sensitivity problem. The direct problem includes two parts, the solution of radiation problem and the free convection heat transfer. Radiation transfer problem is solved by the net radiation method and free convection problem is solved by the finite volume method based on the simpler algorithm. The inverse problem is treated as an optimization problem, wherein, we minimize the sum of square errors between desired and estimated heat fluxes over the design surface. The sensitivity problem is solved by a similar fashion of the direct problem. The performance and the accuracy of the inverse method are investigated for different Rayleigh numbers and incident angles.