

Application of RBF Method to the Estimation of Temperature on the External Surface in Laminar Pipe Flow

*S.Q. Lyu¹, and M. Li¹

¹College of Mathematics, Taiyuan University of Technology, China

*Corresponding author: lvshiqin@163.com

The inverse problem of a finite cooled/heated length on the heat transfer characteristics of laminar flows through thick-walled circular tubes is studied in this paper. Using temperature measurements taken at several different locations within the fluid. The method of radial basis functions is coupled with the boundary control technique to estimate the unknown temperature on the external surface of the circular pipe. The main idea of the proposed method is to solve a direct problem instead of solving the inverse problem directly. The Tikhonov regularization technique and the L-curve method are employed to achieve such goal stably. The temperature data obtained from the direct problem are used to simulate the temperature measurement, and the influence of errors in these measurements upon the precision of the estimated results is also considered. This study also considers the influence of the locations and number of sensors used upon the accuracy of the estimated results. The results indicate that the accuracy of the estimated results is improved by taking temperature measurements in locations close to the inner-wall. Finally, the results confirm that the proposed method is capable of yielding accurate results even when errors in the temperature measurements are present.

Keywords: Radial basis function, Boundary control technique, Laminar pipe flow, Tikhonov regularization