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*Numerical Investigation of Turbulent Flow through Bar Racks in Closed Conduits.* \*S. Paul; H. Ghamry, Freshwater Institute, Department of Fisheries and Oceans Canada, Winnipeg, MB.

Abstract

This research presents the results of numerical investigations of turbulent flow through arrays of vertical bars with different geometrical spacing and blockage ratios in closed conduits. The simulations were performed using two classes of turbulence models: the Reynolds-Averaged Navier–Stokes (RANS) based on turbulence closure models and the Reynolds stress models (RSM). The RANS models comprised the k-epsilon, k-omega, and k-omega-based shear stress transport (SST) while the RSM includes the epsilon-based second moment closure developed by Launder, Reece, and Rodi (LRR) and the omega-based Reynolds stress developed by Speziale, Sarkar and Gatski (SSG). These models were examined using the commercial 3D CFD code, ANSYS CFX-12 in order to select the most appropriate one for prediction of flow in bar racks. The results from a series of closed channel experimental tests conducted at the University of Manitoba Hydraulic Research & Testing Facility were used to assess the adopted turbulence models. Both quantitative and qualitative comparisons of the measured and the predicted by the turbulence models were performed. Predictions were made using bar arrangement with arrays of 3, 7, and 14 bar racks of square leading edges with the approach velocity, U∞ that ranges from 0.26 and 1.42 m/s. The results showed that all the models predict both in trends and values the mean velocity. However, the standard k-epsilon turbulence closure model produced consistently more satisfactory results with lowest computational time over the other models. The results show that the near wake turbulent structure is strongly influenced by the bar spacing (blockage ratio) rather than the approach velocity.