Chapter 6

Entrance and Wall Conduction Effects in Parallel Flow Heat Exchangers

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The short lengths and the comparatively thick walls in microchannel heat exchangers preclude the existence of thermally fully developed flow over a large portion of the heat exchanger and increase the significance of heat conduction in the wall. In this study, a parallel flow heat exchanger is simulated numerically to determine the impact of entrance effects and conduction heat transfer through the walls on the performance of the heat exchanger, including the number of transfer units and the effectiveness. The impact of wall conduction on the heat transfer is studied for different wall thickness and thermal conductivity. It is shown that entrance and wall effects can be incorporated in the longitudinally averaged number of transfer units and accounting for them significantly changes the heat exchanger size for to a given effectiveness.

INTRODUCTION

Full numerical solution of heat exchangers is computationally prohibitive because the flow and temperature fields must be determined simultaneously in at least two fluids and the solid separating the two. The heat exchanger analysis and design are, therefore, based on experimental measurements and analytical solutions obtained for flows in individual ducts subject to