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Three-dimensional Developing Flow in a Long Serpentine Channel SURYA P. VANKA, Department of Mechanical Science and Engineering, University of Illinois at Urbana-Champaign — Serpentine wavy channels are often used as fin passages in compact heat exchangers because of their increased heat transfer performance. However, their benefit is seen only in the unsteady flow regime, and in the turbulent regime. In this work, we study the three-dimensional developing flow in a wavy passage using a finite volume fractional-step Navier-Stokes solver. The geometry consists of a straight approach section, several (8) waves and a stratight section at the end. A curvilinear grid is used to represent the flow domain. Both the steady and unsteady flow regimes are computed by systematically increasing the Reynolds numbers. The effects of the wave amplitude and the wave length are also studied. The structure of the developing flow is presented for different parameter selections. The spanwise structure of the flow on the curved surfaces, and the formation of the recirculating regions in the troughs are presented. Pressure drop characteristics in the developing region are compared with those in the fully-developed periodic region.

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