

Natural Convective Heat Transfer in Porous-Media-Filled Enclosures

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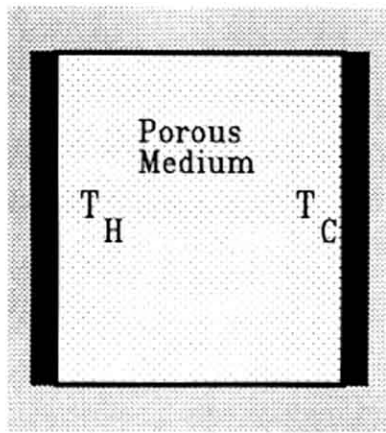
I. INTRODUCTION

Heat transfer by natural convection across porous-media-filled enclosures (or cavities)—here termed porous enclosures—will be considered in this chapter. In such flows, the porous medium, in which there is a buoyancy-driven flow, is entirely enclosed by solid walls along which differential heating is applied, the resulting temperature differences leading to the generation of the buoyancy forces that cause the flow. Some examples of the various types of enclosure being considered are shown in Figure 1. General discussions of the area are given by Bejan (1995), Carbonell and Whitaker (1984), Cheng (1979), Kaviany (1991), and Oosthuizen and Naylor (1998).

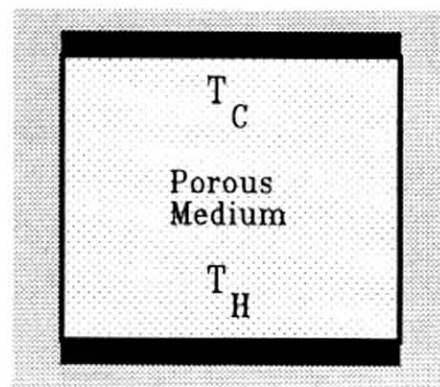
Flow in porous enclosures has received considerable attention, due in large part to the fact that flows of this type occur in a number of practically important situations. Flows of this type arise, for example, in some building and similar applications in which heat is transferred across an insulation-filled enclosure. Other examples occur in geothermal and oil extraction applications.

II. VERTICAL AND INCLINED RECTANGULAR ENCLOSURES

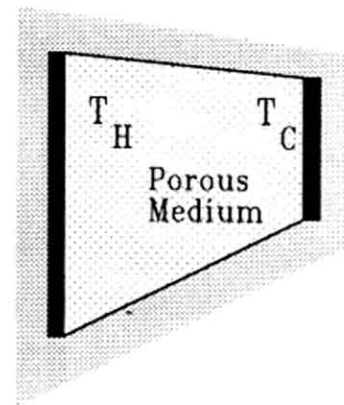
The most widely considered situation involving a porous enclosure is that of a rectangular enclosure completely filled with a saturated porous medium and with one wall heated to a uniform temperature, T_H , the opposite wall



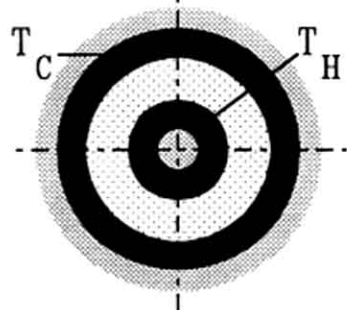
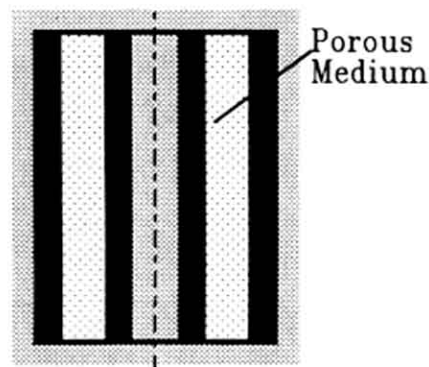
(a) Vertical Rectangular Enclosure



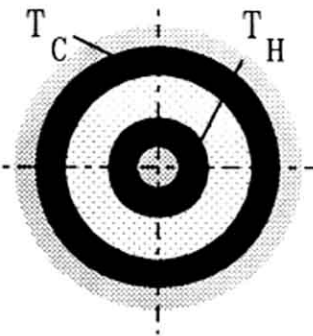
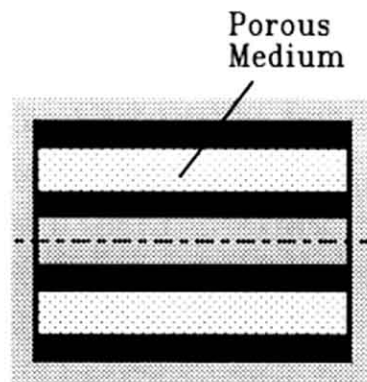
(b) Horizontal Rectangular Enclosure



(c) Vertical Non-Rectangular Enclosure



(d) Vertical Annular Enclosure



(e) Horizontal Annular Enclosure

Figure 1. Examples of types of enclosure being considered in the present chapter.