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ANALYSIS OF HEAT TRANSFER PROCESS IN THERMAL COLLECTORS

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The role of convection and conduction heat transfer in the performance of solar systems is obvious. Radiation heat transfer plays an important role in bringing solar energy to earth, but it is not so manifest that radiation heat transfer plays a significant role in the operation of solar collectors. The calculation of the heat loss can be very complicated, because of the variant components. Usually in practice radiation heat transfer is often negligible (Duffie and Beckman, 1991). In a thermal collector flux of the solar energy is large-scale smaller than in conventional heat transfer equipment. In addition to required preciseness, one must be taken to account available accuracy.

Emissivity of the absorber plate is specially characterized by the selective coatings where emissivity may have fluctuating between 10-50% (Spuckler & Siegel, 1992). This value is depending on the type and manufacture of the coating. It is difficult to anticipate the convective heat transfer with better than 20% accuracy. In solar collectors the heat is extracted by the heat transfer fluid, which flowing through the tubes (Shah and Furbo, 2007). In this paper the heat flow from the absorber to fluid through the tube wall is analyzed. Usually the conductance of the absorber and tube wall material has good thermal conductivity, but it has to be taken to the account in a correct model. The heat flow from wall to fluid occurs by convection and is described by the convective coefficient. Even though the achievable overall accuracy of a heat loss calculation may be quite low, there are situations where one would like to model certain details with much greater preciseness.

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