

The topic of heat transfer enhancement has attractive attentions to develop the compact heat exchanger design in order to obtain a high efficiency, low cost, light weight and size as small as possible. Therefore, the energy costs and environment considerations motivate researchers to optimize the thermal systems performance over the existing designs.

This study provides an overview on the investigations published in the last two decades particularly the recent studies published to improve the thermal systems design with minimal negative effects on the environment with high level of energy economic. Several parameters have been reviewed in this paper, which have pronounced effects on the free, mixed and forced convection heat transfer and pressure drop penalty. These parameters are: inner cylinder position, cross-sectional shape of the annulus, straight and curved annuli, moving one of cylinders of annulus, using of porous media, replacing base fluids by nanofluids, design the annuls with narrow gap between the two cylinders, effect of the size of the annulus (mini and micro scale size), using surface roughness, effect of critical heat flux, considering of surface radiation, boiling and refrigeration, and finally effect of surface vibration and applying of external magnetic field on the working fluid.

In addition, this study specifies the weakness points and the gap in this area of research which have not been investigated yet. These uninvestigated areas in annuli are still need more attentions investigations efforts from the researchers in order to get the optimum design for the annuli in different applications. Therefore, this article provides recommendations and hot topics require further investigational efforts to fulfill these gaps for more energy consumption and environment saving.