Modeling of wire-on-tube heat exchangers using finite element method

Abstract

Wire-on-tube heat exchangers are analysed under normal operating conditions (free convection) using finite element method. Galerkin's weighted residual method is used to minimise the errors. The effects of ambient temperatures and mass flow rates of the refrigerant are determined. This is used to find out the length of tube required for phase change for its initiation and completion. The methodology adopted is validated against the existing data for both sensible heat and latent heat transfer. The analysis also leads to the information about the adequacy of the number of tubes for complete condensation of the refrigerant vapour under given operating conditions different from that of design conditions. This methodology can be used as a design tool for the design of wire-on-tube heat exchangers. The derating of heat exchangers under abnormal ambient conditions can also be predicted.

Keywords — Wire on-tube heat exchangers, free convection, finite element method, phase change