Modeling of Thermodynamic Properties for Pure Refrigerants and Refrigerant Mixtures by Using the Helmholtz Equation of State and Cubic Spline Curve Fitting Method

Halil Atalay [C, S] and Turhan Çoban
Mechanical Engineering Department, Bozok University, Yozgat, Turkey
halil.atalay@bozok.edu.tr

When simulating refrigeration systems or equipment, knowledge of refrigerant thermodynamic properties is required. While some of the refrigerants are made of pure fluids, some of these refrigerants are made by mixing of two or more pure refrigerants with a predetermined percentages. In modern trade and science, it is compulsory to get the same results in everywhere for the same inputs or measurements. Properties of refrigerants are a major part of international trade, therefore, it is a subject of interest of international standards. International Standard Organization (ISO) was prepared a standard for calculating real gas equation of states, for pure fluids and mixtures. The standard name is ISO 17584:2005(E). In the standard, Equations of States were given in Helmholtz free energy form. In this study a computer model was developed based on ISO 17584 equation of state and cubic spline curve fitting models developed by using saturation thermophysical properties of the refrigerants and refrigerant mixtures. Java programming language was used to model equation of state. As an example the equations for R1234yf and R410A were presented in this paper. With the new model, thermodynamic properties of R1234yf and R410A were compared with REFPROP 9.0. It shows that the total mean deviations of the new model are less than 0.5%.