0.1 Enthalpy of Mixtures

The enthalpy of a mixture is determined using an equation of state by combining the departure function for the mixture with the enthalpy of an ideal gas mixture

$$H = (H - H^{ig}) + H^{ig} = (H - H^{ig}) + \sum_i x_i H_i^{ig} \qquad 0.1$$

where the first term on the right side represents the enthalpy departure given by Eqn. 7.24 or Eqn 7.31. For the Peng-Robinson equation, the departure formula has been calculated in Example 7.3. The equation of state parameters depend on composition as provided by Eqn. 10.9. The summation of the ideal gas enthalpies Eqn. 0.1 is easily calculated after selecting a reference state for each component. For a fluid that is not an ideal gas at the reference state

$$H_i^{ig} = \int_{T_R}^{T} C_P^{ig} dT - (H - H^{ig})_R + H_R \qquad 0.2$$

Each component may have a different reference state temperature, pressure and state of aggregation. For components that are solids at the reference state, the latent heat of fusion must be included in the enthalpy calculation by modifying Eqn. 0.2 since solid properties are not calculable by conventional equations of state. One such modification might result in

$$H_i^{ig} = \int_{T_m}^{T} C_P^{ig} dT - (H^L - H^{ig})_{T_m} + \Delta H^{fus} + \int_{T_R}^{T_m} C_P^S dT + H_R^S \qquad 0.3$$

The actual calculation pathway used to calculate H_i^{ig} depends on the quality and availability of thermochemical data.