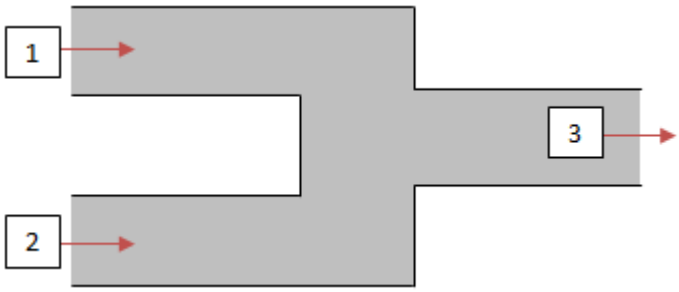
Adiabatic Mixing of Humid Air

Two streams of humid air at known conditions are mixed adiabatically. This application will calculate the properties of the mixed air.



Get data from ThermophysicalData package

```
Property := ThermophysicalData:-Property
```

Parameters

Temperature	$T_1 := 303\ K$	$T_2 := 275\ K$
Flowrate	$V_1 := 0.333\ m^3 \cdot s^{-1}$	$V_2 := 0.417\ m^3 \cdot s^{-1}$
Relative humidity	$R_1 := 0.4$	$R_2 := 0.9$
Pressure	$P_1 := 101325\ Pa$	$P_2 := 101325\ Pa$

Properties of Stream 1

Enthalpy	$h_1 := Property(\text{enthalpy}, \text{HumidAir}, \text{Tdb} = T_1, \text{R} = R_1, \text{P} = P_1) = 57.014\ \frac{kJ}{kg}$
Humidity ratio	$hr_1 := \text{Property}(\text{humidityratio}, \text{HumidAir}, \text{Tdb} = T_1, \text{R} = R_1, \text{P} = P_1) = 0.011$
Specific volume	$v_1 := \text{Property}(\text{volume}, \text{HumidAir}, \text{Tdb} = T_1, \text{R} = R_1, \text{P} = P_1) = 0.873\ \frac{m^3}{kg}$
Mass flowrate	$m_1 := V_1 / v_1 = 0.382\ \frac{kg}{s}$

Properties of Stream 2

Enthalpy $h_2 := \text{Property}(\text{enthalpy}, \text{HumidAir}, \text{Tdb} = T_2, R = R_2, P = P_2) = 11.620 \ \frac{kJ}{kg}$

Humidity ratio $hr_2 := \text{Property}(\text{humidityratio}, \text{HumidAir}, \text{Tdb} = T_2, R = R_2, P = P_2) = 0.004$

Specific volume $v_2 := \textit{Property}(\text{volume}, \text{HumidAir}, \text{Tdb} = T_2, R = R_2, P = P_2) = 0.783 \ \frac{m^3}{kg}$

Mass flowrate $m_2 := V_2 / v_2 = 0.532 \ \frac{kg}{s}$

Properties of Stream 3

Total mass flowrate of $m_3 := m_1 + m_2 = 0.914 \ \frac{kg}{s}$

Humidity ratio and specific enthalpy $hr_3 := \frac{1}{m_3} \cdot (hr_1 \cdot m_1 + hr_2 \cdot m_2) = 0.007$ $\quad h_3 := \frac{1}{m_3} \cdot (h_1 \cdot m_1 + h_2 \cdot m_2) = 30.575 \ \frac{kJ}{kg}$

Temperature $T_3 := \text{Property}(\text{Tdb}, \text{HumidAir}, \text{pressure} = 101325, H = h_3, W = hr_3) = 286.778 \ K$

Plot the mixing process on a psychrometric chart

```
pts := [[T_1, hr_1], [T_3, hr_3], [T_2, hr_2]]

mixLines := plots:-pointplot(pts, connect = true, thickness = 5)
mixPoints := plots:-pointplot(pts, connect = false, symbol = solidcircle,
symbolsize = 15, color = red)
```

```
plots:-display(ThermophysicalData:-PsychrometricChart( ), mixLines, mixPoints) =
```