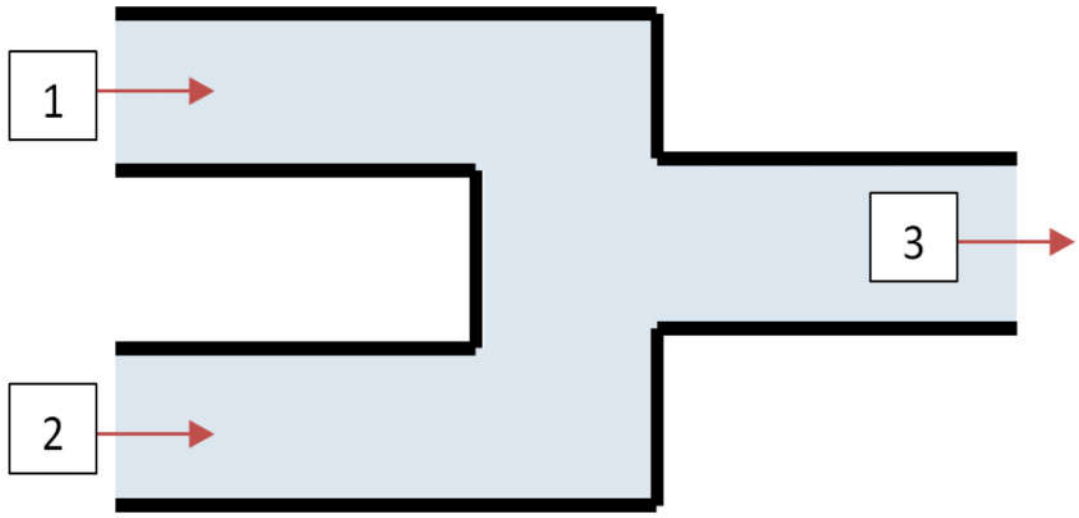
Mixing Humid Air

Introduction

Two parcels of humid air at known conditions are mixed. This application will calculate the temperature of the resulting mixture, and plot the thermodynamic process on a psychrometric chart.




```
> restart :
  with( ThermophysicalData ) :
  with( plots ) :
  with( Units[ Standard ] ) :
```

Parameters

Mass of first parcel of humid air

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> m_1 := 1000 kg :
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Temperature of of first parcel of humid air

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> T_1 := 303.15 K :
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Relative humidity of first parcel of humid air

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> R_1 := 0.6 :
```

Mass of second parcel of humid air

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> m_2 := 1500 kg :
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Temperature of of first second of humid air

```
> T_2 := 283.15 K :
```

Relative Humidity of second parcel of humid air

```
> R_2 := 1 :
```

Pressure of both air parcels

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> pressure := 10^5 Pa :
```

Calculations

Specific enthalpy of first and second air parcels

> $h_1 := \text{Property}(H, \text{HumidAir}, T = T_1, P = \text{pressure}, R = R_1)$

$$h_1 := 71926.78769 \ \frac{J}{kg} \tag{3.1}$$

> $h_2 := \text{Property}(H, \text{HumidAir}, T = T_2, P = \text{pressure}, R = R_2)$

$$h_2 := 29616.01063 \ \frac{J}{kg} \tag{3.2}$$

Humidity Ratio of first and second air parcels

> $hr_1 := \text{Property}(\text{humidityratio}, \text{HumidAir}, T = T_1, P = \text{pressure}, R = R_1)$

$$hr_1 := 0.01633493511 \tag{3.3}$$

> $hr_2 := \text{Property}(\text{humidityratio}, \text{HumidAir}, T = T_2, P = \text{pressure}, R = R_2)$

$$hr_2 := 0.007765108778 \tag{3.4}$$

Mixture enthalpy from an adiabatic heat balance

> $$h_{mix} := \frac{h_1 \cdot m_1 + h_2 \cdot m_2}{m_1 + m_2}$$

$$46.54032144 \ \frac{kJ}{kg} \tag{3.5}$$

Mixture relative humidity from a mass balance

> $$R_{mix} := \frac{m_1 \cdot R_1 + m_2 \cdot R_2}{m_1 + m_2}$$

$$R_{mix} := 0.8400000000 \tag{3.6}$$

Mixture humidity ratio

> $hr_{mix} := \text{Property}(\text{humidityratio}, \text{HumidAir}, H = h_{mix}, P = \text{pressure}, R = R_{mix})$;

$$hr_{mix} := 0.01115076321 \tag{3.7}$$

Mixture temperature

> $T_{mix} := \text{Property}(T, \text{HumidAir}, H = h_{mix}, P = \text{pressure}, R = R_{mix})$;

$$T_{mix} := 291.3305675 \ K \tag{3.8}$$

Plotting the Thermodynamic Process

> $pts := \text{convert}\tilde{}\tilde{}([[T_1, hr_1], [T_{mix}, hr_{mix}], [T_2, hr_2]], \text{unit\_free})$

$$pts := [[303.15, 0.01633493511], [291.3305675, 0.01115076321], [283.15, 0.007765108778]] \tag{4.1}$$

> $mixPoints := \text{pointplot}\left(pts, \text{connect} = \text{false}, \text{symbol} = \text{solidcircle}, \text{symbolsize} = 15, \text{color} = \text{RGB}\left(\frac{150}{225}, \frac{40}{255}, \frac{27}{255}\right)\right)$:

```
mixLines := pointplot( pts, connect = true, thickness = 5 ) :
> display( PsychrometricChart( ), mixLines, mixPoints)
```