4.6: Thermal Equations of the mixed gases

- If there are two components of gases named A and B, while their T is T_A and T_B repetitively.
- After they have been mixed their final temperature is T_2.

$$m_A c_A (T_A - T_2) = m_B c_B (T_2 - T_B)$$

XIII: Real Substances and Property Tables

1: Introduction

1.1: Real Substances

- Not all the substances behave like ideal gases.
- Cannot use ideal gas law
- **Solution**: looking things up in the **Property table.**
  - Moran and Shapiro

1.2: Notation

- Lower letter usually denotes a specific quantity.
- Tile $\sim$ is a molar quantity.
- Examples:
  - u is specific internal energy.
  - h is specific enthalphy, $h = u + pv$, which has unit of kJ/kg.
- Subscript:
  - s means saturated.
  - f means saturated liquid.
  - g is saturated vapour.
  - fg denotes change of phase at constant pressure.
  - $h_{fg} = h_g - h_f$

2: Linear interpolation

2.1: Example_1

- No entry to find the specific latent heat of vaporisation at 63 degrees from the table.
- There are values at 60 and 65.
- So we interpolate at 60 and 65.
- $\alpha = \dfrac{63-60}{65-60} = 0.6$
- Solution:

$$h_{fg}[63] = h_{fg}[60] + \alpha(h_{fg}[65] - h_{fg}[60]) = 2351.1kJ/kg$$

2.2: Dryness Fraction

- A saturated mixture is made up of part of vapour and part of liquid.
- We quantify just how much using the dryness fraction x.
- x only defined when saturated.
- $x = 1$ means dry- saturated vapour.
- $x = 0$ means wet-saturated liquid.
- Specific Enthalpy:

$$h(x) = h_f + x(h_g - h_f)$$

- Specific volume:

$$v(x) = v_f + x(v_g - v_f)$$

3: The classification of steam (gases)

3.1: Unsaturated steam

- During the vaporization continuing, if the mount of the water molecules **flying into the air** is less than that **enter the water from the air**, we call it **unsaturated steam**, cause the vaporization still can processing.

3.2: Saturated steam

- When the water molecules flying into the air equal to that enter the water, i.e reach a balance, we call it **saturated steam** cause the vaporization stopped.

3.3: Superheated steam

- When the water have already reach the saturated steam but we still increase the temperature, so the T has over the **saturation temperature** at this pressure, it will be **Superheated steam** as a kind of **unsaturated steam** so we have to use another table to do the linear interpolation.