my thermodynamics cheat sheets

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Summer 2004  Compiled on May 23, 2020 at 4:09am

1. all of thermodynamics in one sheet.
   (a) PDF
   (b) image

2. polytropic process diagrams
   (a) PDF
   (b) image

3. first and second laws diagrams
   (a) PDF
   (b) image

4. Gas laws
   (a) PDF
   (b) image

All of thermodynamics in one sheet
We have a total of 7 unknowns: 3 in state 1, 3 in state 2, and n, the polytropic process exponent. If given any 5 out of these 7, then the remaining 2 can be found. For example, if we know $T_1$, $P_1$, $V_1$, $P_2$, then we can find $V_2$ and $T_2$.

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Figure 2: polytropic process diagrams
Laws of thermodynamics

First law

This is also called the law of conservation of energy

Chapter 5: 1st law for control volume

\[ Q_{in} + W_{in} + m_i(h + PE + KE)_{i} = Q_{out} + W_{out} + m_e(h + PE + KE)_{e} + (m_2u_2 - m_1u_1) \]

Gibbs relations

\[ T \, ds = du + P \, dv \]

\[ T \, ds = dh - v \, dp \]

For solids and liquids, \( \Delta s = 0 \)

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Hence for solids and liquids, \( \Delta s = C_s \, dt \)

\[ s_2 - s_1 = C_s \ln \frac{T_2}{T_1} \]

\( \Delta h = h_2 - h_1 = C_H \left( T_2 - T_1 \right) \)

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\[ \frac{\Delta h}{\Delta s} = \frac{C_H}{C_s} \]

Specific work (work in moving boundary work) [\( P \, dv \)]

\[ w_{gen} = w_{cal} \left( T_2 - T_1 \right) \]

\[ w_{gen} = \frac{w_{gen}}{\left( T_2 - T_1 \right)} \]

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Second law

The meaning of an isolated system breaks local real processes and is conserved in reversible processes.

The reversible entropy of an isolated system decreases in all real processes and is conserved in reversible processes.

The entropy of an isolated system is conserved in all real processes, but is conserved if the system is reversible.

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Image1.jpg

Figure 3: first and second laws diagrams
Figure 4: gas lawss