Lect 13– Thermo I CV 1st Law

1. Able to use conservation of energy equations for a steady state process.
2. Able to use conservation of energy equations for a transient process.

Application Problem – The Hoover Dam
Application Problem Ex. 6.3 – Heat Exchanger

Given: A water cooled condenser in a system using R-134a. Refrigerant enters at 1.0 MPa and 60°C at a rate of 0.2 kg/s & exits as a liq. 0.95 MPa, 35°C. Cooling water enters at 10°C, exits at 20°C.
Find: water flow rate
Application Problem – Nozzles

Control surface

$V_i = 50 \text{ m/s}$
$p_i = 0.6 \text{ MPa}$
$T_i = 200^\circ\text{C}$

$V_e = 600 \text{ m/s}$
$p_e = 0.15 \text{ MPa}$

$h_i + \frac{V_i^2}{2} = h_e + \frac{V_e^2}{2}$

Application Problem – Diffuser
Application Problem – Throttle

key phrase: “sudden change in flow area”

Application Problem – Steam Turbine

\[ \dot{m}_1 = 1.5 \text{ kg/s} \]
\[ P_1 = 2 \text{ MPa} \]
\[ T_1 = 350^\circ C \]
\[ \dot{V}_i = 50 \text{ m/s} \]
\[ Z_i = 6 \text{ m} \]

\[ \dot{m}_e = 1.5 \text{ kg/s} \]
\[ P_e = 0.1 \text{ MPa} \]
\[ x_e = 100\% \]
\[ V_e = 100 \text{ m/s} \]
\[ Z_e = 3 \text{ m} \]
Application Problem – Gas Turbine

Application Problem – Compressors
Application Problem – Steam Power Plan

An excellent application for EES or any other math tool

Application Problem – Transient Fill

1.4 MPa, 300°C

Initially evacuated
Application Problem – Transient Emptying