**Problem: 3-1**

**Find:** The availability of water at its critical point
**Assume:** The dead state is at 20 $^\circ C$ and 1 atm.

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For $T_0 = 20\ ^\circ C$ and $P_0 = 0.10135\ MPa$ the properties of water at its dead state (0) [20$^\circ C$, 0.10135 $MPa$] are close to those of saturated liquid water at 20 $^\circ C$. From Table B-1a

$$\begin{aligned} u_0 &= 83.9\ kJ/kg \\ v_0 &= 0.001002\ m^3/kg \\ s_0 &= 0.2965\ kJ/(kg \cdot K) \end{aligned}$$

$$\begin{aligned} u &= 2029.6\ kJ/kg \\ v &= 0.003155\ m^3/kg \\ s &= 4.4305\ kJ/(kg \cdot K) \end{aligned}$$

The availability is given by:

$$\begin{aligned} \phi - \phi_0 &= (u - u_0) + P_0(v - v_0) - T_0(s - s_0) \\ &= (2029.6 - 83.9)\ kJ/kg + 101.35\ kN/m^2(0.003155 - 0.001002)\ m^3/kg \\ &\quad -(20 + 273.15)\ K(4.4305 - 0.2965)\ kJ/(kg \cdot K) \\ &= 734.04\ kJ/kg \end{aligned}$$