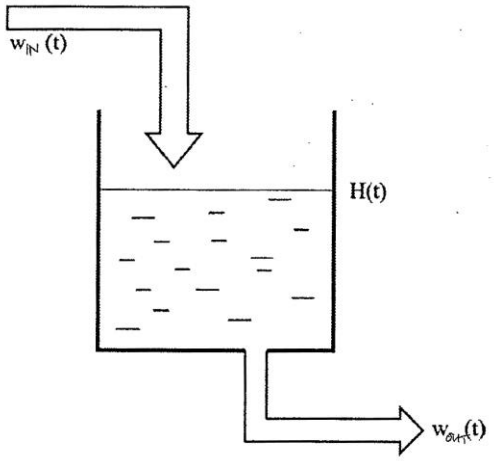
Liquid level tank with forced outflow

Fluid flows in with flow rate w_{in} to a vessel with vertical walls and constant horizontal cross section area B, and **sucked out from it by a pump with a controlled** w_{out}. The liquid level in the vessel is denoted by H.



The outlet flow rate is nothing to do with the liquid level in the tank but **is forced by the pump**.

Suppose an initial steady state is characterized by $w_{in}=w_0=w_{out}$ and $H=H_0$, and then the inlet flow rate changes arbitrarily. How will liquid level H change in time?

The dynamic material balance is

$$w_{in}(t) = w_{out}(t) + B \cdot \frac{dH(t)}{dt}$$

After rearrangement:

$$\frac{dH(t)}{dt} = \frac{1}{B} \cdot \left(w_{in}(t) - w_{out}(t)\right)$$

This is the equation of an integrating element with input signal $w_{in}-w_{out}$, output signal H, and gain 1/B.