Description of a case study

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1 Case Study

A simple one tank system (Fig. 1).

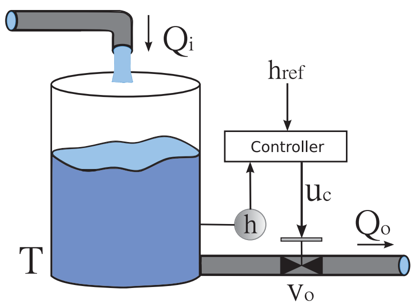

Figure 1: Diagram of the tank system.

The system is represented by the following set of equations:

Constraint	Equation	Component	Fault
$c_1 : (\dot{h}, Q_i, Q_o)$	$e_1 : A\dot{h} = Q_i - Q_o$	T	f_T
$c_2 : (h, \dot{h})$	$e_2 : h = \int_0^t \dot{h} \cdot dt$		
$c_3 : (Q_o, u_c, h)$	$e_3 : Q_o = K_c\sqrt{h \cdot u_c}$	V_o	f_{V_o}
$c_4 : (u_c, h)$	$e_4 : u_c = pid(h)$	PI	
$c_5 : (h^*, h)$	$e_5 : h = h^*$	LT	f_{LT}
$c_6 : (Q_o^*, Q_o)$	$e_6 : Q_o = Q_o^*$	FT_1	f_{FT_1}
$c_7 : (Q_i^*, Q_i)$	$e_7 : Q_i = Q_i^*$	FT_2	f_{FT_2}

Where Q_i and Q_o are the input and output flows to the tank, T, h represents the level of the tank, and u_c is the PID signal that controls the opening of valve V_o. A is the cross section of the tank, and K_c is the valve constant. Three sensors, LT, FT_2, and FT_1 measure the variables h, Q_i, and Q_o, respectively, and we represent such values as h^*, Q_i^*, and Q_o^*. In this plant, we consider faults in the level and output sensors, f_{LT} and f_{FT_1}, respectively, leakages in tank T, f_T, and partial blocks of valve V_o, f_{V_o}.