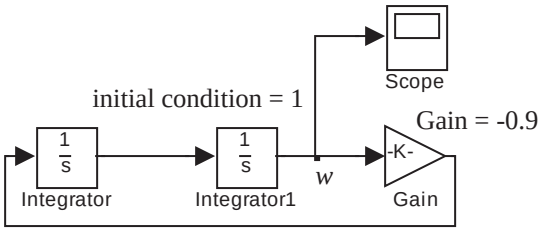
EECS20n, Quiz 3

Solution

1. For the Simulink diagram shown below, write a differential equation (with no integrals, just derivatives) that describes the signal w.



Solution:

$$\forall\, t \in \textit{Reals}_+, \quad \ddot{w}(t) = -0.9w(t).$$

2. The Simulink diagram in the previous problem can be described as a first-order differential in the following form:

$$\forall\, t \in \textit{Reals}_+, \quad \dot{z}(t) = Az(t).$$

Give a definition of z in terms of w and give A.

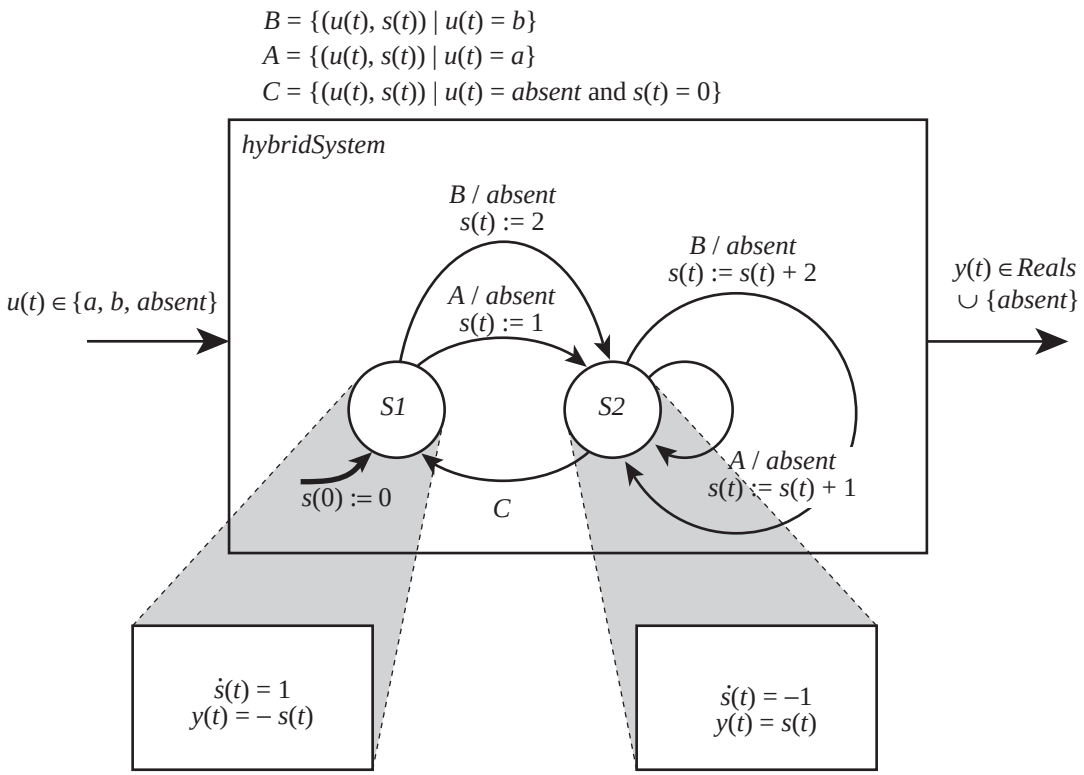
Solution:

$$\forall\, t \in \textit{Reals}_+, \quad z(t) = \begin{bmatrix} w(t) \\ \dot{w}(t) \end{bmatrix} \quad A = \begin{bmatrix} 0 & 1 \\ -0.9 & 0 \end{bmatrix}.$$

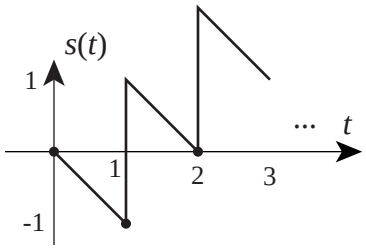
3. For the following hybrid system, assume the input is given by

$$\forall\, t \in \textit{Reals}, \quad u(t) = \begin{cases} a & \text{if } t = 1 \\ b & \text{if } t = 2 \\ \textit{absent} & \text{otherwise} \end{cases}$$

Sketch the output over the range $t \in [0, 3]$.



Solution:



In addition, at times $t = 1$ and 2, the output is *absent*.