

ENEE 660 Fall 2010 Homework 8 } due in  
class  
November 9

1. Find a finite dimensional linear dynamical system that yields a weighting pattern of the form:

(i)  $T(t, \sigma) = \sin(t) \sin(\sigma),$

(ii)  $T(t, \sigma) = \sin(t - \sigma).$

For which of these two cases can a time-invariant realization be found?

2. Read Lecture Notes 5 (Floquet Theory) and do problem 3 in section 9 page 53 of R.W. Brockett. [This material was sent to you by email]

3. Consider a time-varying scalar system of the form

$$\begin{aligned} \ddot{x}(t) + a \dot{x}(t) + b x(t) \\ = \dot{u}(t) + f(t) u(t) \end{aligned}$$

with  $a$  and  $b$  constants and  $f$  differentiable. Find a first order vector differential equation representation of the system. Find the weighting pattern relating  $x$  and  $u$ .

4. Show that the weighting pattern associated with the system

$$\begin{aligned} \dot{x}(t) &= Ax(t) + e^{tF} B u(t) \\ y(t) &= C e^{-tF} x(t) \end{aligned}$$

is stationary if  $FA = AF$ . In that case, calculate it.

5. Show that a constant realization  $[A, B, B^T]$  with  $A = -A^T$  has a weighting pattern of the form

$$T(t, \sigma) = G(t) G^T(\sigma)$$