

Homework Set 3 (ENEE664 – spring 2014) – due 02/19/2014; In problem 3 compute for  $\alpha = 1$  and 2 (write general code – include your code with solutions as a printout)

Problem 1

For the time invariant system

$$\dot{x} = Ax + Bu + Cv$$

with a known disturbance  $v(t)$ , suggest/derive a control that drives the system from  $(x_0, 0)$  to  $(0, T)$  and minimizes

$$\eta = \int_0^T u'(t) u(t) dt$$

state any needed hypotheses clearly.

Problem 2

Complete the proof the necessary conditions theorem in Lecture Notes 3 (page 5, part (c)).

Problem 3

Consider the problem of finding an optimal control

for the system:  $\dot{x} = -\alpha x + u$   $\alpha > 0$ ;

st  $\eta = \int_0^1 (x^2 + u^2) dt + \alpha x(1)$ ; with initial  $x(0) = 1$ .

Use a numerical approach based on canonical equations (and MATLAB) to investigate this problem.

What is the optimal value  $\eta_{\min}$ ?