Closed Loop System Phase portrait
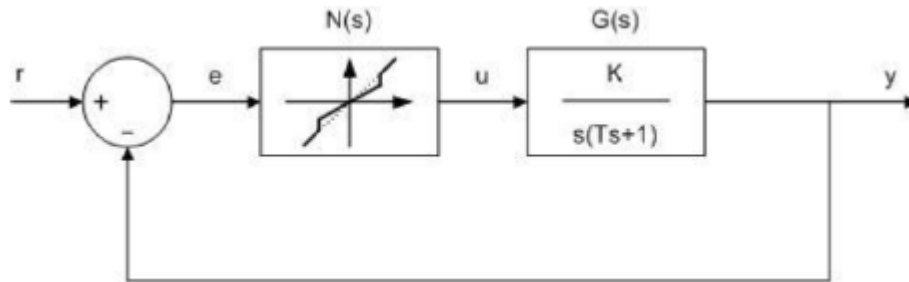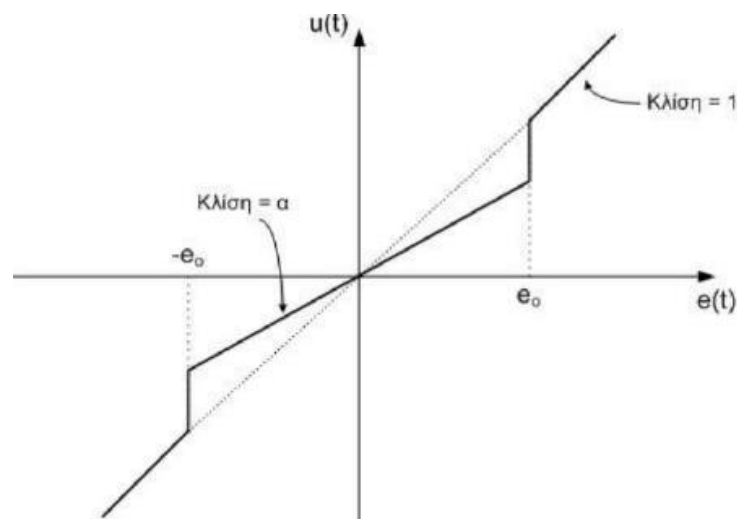
Given the closed loop system with T=1, K=4 and r(t) is the input signal, y(t) the output and e(t) is feedback error:

N(s) is variable profit function and is a non-linear element with a characteristic input-output curve as shown in the following figure:

A) We first consider that the variable gain function N (s) does not exist (u = e). Calculate the graphs of the time response of the state variables as well as the phase portrait of the system for the two inputs. Use the initial values of the state variables given at the end of the utterance (simulate the system using the matlab and the ode45 function).Initial values of status variables:

(-2,1.5) , (-2.5,0.8) , (1.5,2) , (0.2,1.8) , (2.5,-0.8) , (2,-2) , (-0.2,-1.8) και (-1,-2.5).

B) We then consider that the variable gain function N (s) exists with e0 = 0.2 and α = 0.06. Calculate the phase portrait of the system for the two inputs of question A and in addition for the cases where the slope of the ramp is V = 0.04 and V = 0.4. Use the initial values of the state variables given at the end of the utterance (simulate the system using the matlab and the ode45 function). Initial values of status variables:

(-2,1.5) , (-2.5,0.8) , (1.5,2) , (0.2,1.8) , (2.5,-0.8) , (2,-2) , (-0.2,-1.8) και (-1,-2.5).