Control Systems: Competition 1
Due: 2019/11/22 21:00

Problem Description
The transfer function of a satellite control system has been identified as:

$$P(s) = \frac{-1.202(s-1)}{s(s+9)(s^2+12s+56.25)} \tag{1}$$

Please design a controller $C(s)$ to stabilize the open-loop plant $P(s)$ (see Fig. 1 for the closed-loop feedback control architecture) and to optimize the closed-loop step response performance according to the given cost function J as defined below, i.e., design a controller $C(s)$ that minimizes the cost J.

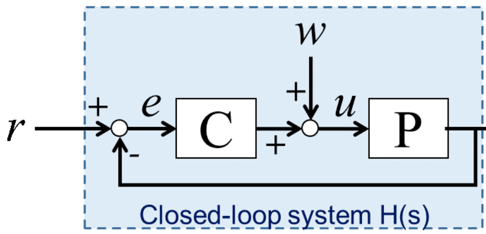

Figure 1: The architecture of closed-loop feedback control.

Cost Function The cost function J to be minimized is defined as

$$J := 10t_r + t_s + 20M_o + 100e_{ss} \tag{2}$$

(t_r: rise time [sec]; t_s: settling time [sec]; M_o: maximum overshoot, which is the positive peak value of the output y; e_{ss}: steady-state error of tracking a unity step input.)

The evaluation of this assignment is based on the final cost you get, as illustrated in Fig. 2.

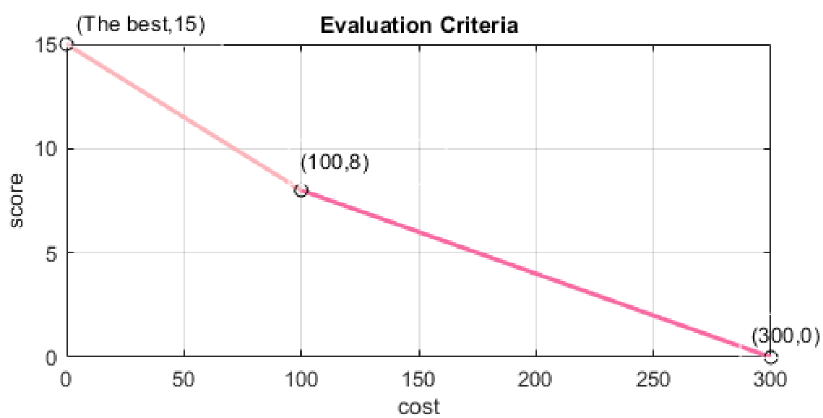

Figure 2: The evaluation criteria.

Submission

1. Please describe how you designed the controller C(s).
2. Save your report in PDF format, zip it together with your .m files and upload to NTU COOL. Name your file as [Student ID]_competition1.zip .

Warning: If you plagiarized other's design, the competition score goes zero.