

**Control Systems Course, Academic Year 2011-2012**

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**Part 1 test, January 10<sup>th</sup> 2012**

Available time: 2h

**Ex1** Given a plant characterized by the transfer function

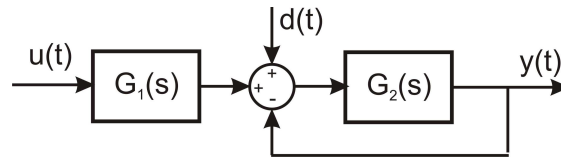
$$G(s) = \frac{s+3}{s(s-3)},$$

design a control scheme and a controller  $G_c(s)$  such that:

1. the closed loop system is astatic with respect to a step additive disturbance applied to the output of the plant  $G(s)$ ;
2. the steady state error with respect to a ramp input is smaller than 0.1;
3. the settling time  $T_s$  is smaller or equal to 1 s;

Compute the output time signal of the obtained closed loop system for an impulse reference signal.

**Ex2** Given a plant characterized by the following block diagram model



where  $G_1(s) = \frac{1}{s+1}$  and  $G_2(s) = \frac{1}{s-1}$ , derive the transfer function  $G(s) = \frac{Y(s)}{U(s)}$  and design a control scheme and a controller  $G_c(s)$  such that:

1. the closed loop system is astatic with respect to the step additive disturbance  $d(t)$ ;
2. the steady state error with respect to a parabola input is smaller than 0.1.

Discuss the steady state behavior of the system with respect to polynomial additive disturbances applied to the output of the plant.

**Ex3** Discuss the design specifications on the transient response of a feedback control system, and provide one illustrative example.

**Note:** At the end of the exam you can decide either to give us your test or not. If you give us your test, your mark obtained in a previous test, regarding this part of the Control System course, is directly replaced by the mark obtained in the current test.