Master of science-level in Mechanical Engineering
Academic Year 2019-2020, Second Semester

Automatic Control (05LSLQD, 05LSLNE)

Vito Cerone

Homework n. 8

Main learning objectives

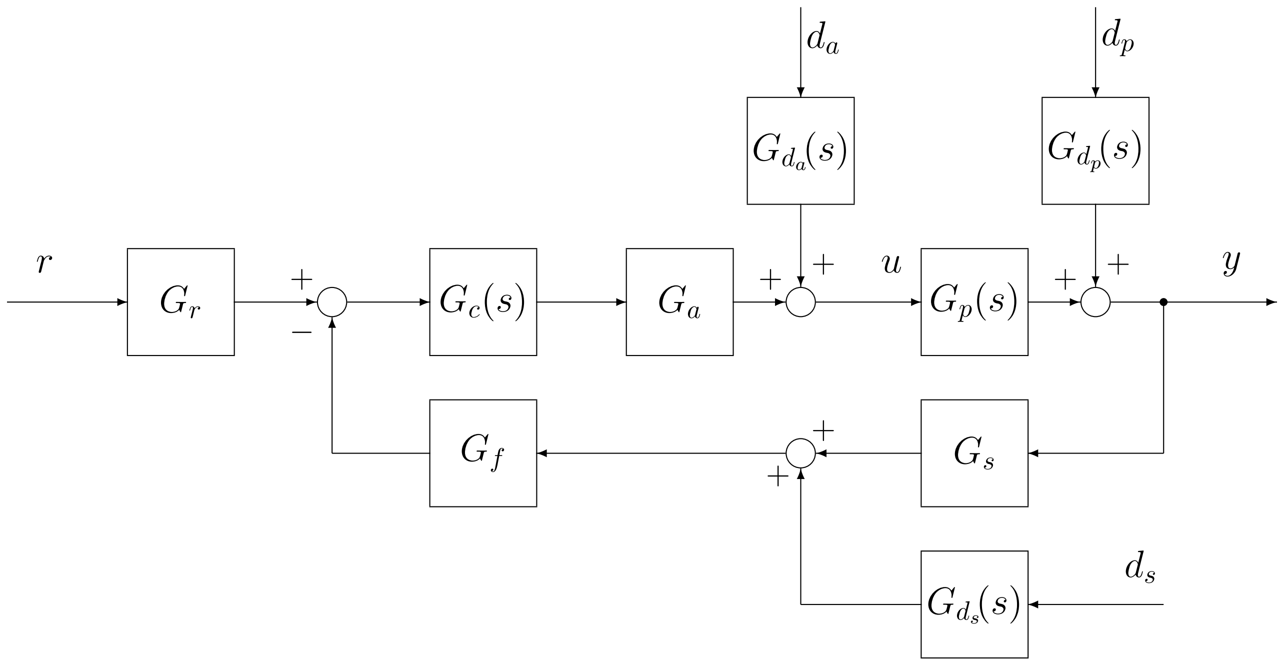
The main learning objectives of this homework is to let students practice with typical written exams.

Master of science-level in Mechanical Engineering
Academic Year 2019-2020, Second Semester

Automatic Control (05LSLQD, 05LSLNE)

Exam simulation no. 1

Consider the feedback control system below.



$$G_p(s) = \frac{25}{s^3 + 3.3s^2 + 2s}$$

$G_s = 1$
$G_a = 0.095$
$G_r = 1$
$G_{da}(s) = 1; \quad G_{dp}(s) = 1; \quad G_{ds}(s) = 1$
$d_a(t) = D_{a0}; \mid D_{a0} \mid \leq 5.5 \cdot 10^{-3};$
$d_p(t) = a_p \sin(\omega_p t), \quad \mid a_p \mid \leq 2 \cdot 10^{-2}, \ \ \omega_p \leq 0.02$ rad s^{-1}.
$d_s(t) = a_s \sin(\omega_s t), \quad \mid a_s \mid \leq 10^{-1}, \ \ \omega_s \geq 40$ rad s^{-1}.

Specifications
(S1) Steady-state gain of the feedback control system: $K_d = 1$
(S2) Steady-state output error when the reference is a ramp $(R_0 = 1)$: $\mid e_r^\infty \mid \leq 1.5 \cdot 10^{-1}$
(S3) Steady-state output error in the presence of d_a: $\mid e_{d_a}^\infty \mid \leq 1.5 \cdot 10^{-2}$
(S4) Steady-state output error in the presence of d_p: $\mid e_{d_p}^\infty \mid \leq 5 \cdot 10^{-4}$.
(S5) Steady-state output error in the presence of d_s: $\mid e_{d_s}^\infty \mid \leq 5 \cdot 10^{-4}$.
(S6) Rise time: $t_r \leq 3$ s
(S7) Settling time: $t_{s,\,5\%} \leq 12$ s
(S8) Step response overshoot: $\hat{s} \leq 10\%$

Design of controllers G_f and $G_c(s)$.

- **Part 1**
  - (A) **10 Points**
    - (A.1) Translate given performance specifications into suitable parameters for the design of controllers $G_c(s)$ and G_f, that provides fulfillment of performance requirements.
    - (A.2) Discuss the sign of the generalized steady-state gain K_c for which the control system is stabilizable with dynamical networks (phase-lead and/or phase-lag).
- **Part 2**
  - (B) **10 Points** — Design a controller that guarantees fulfillment of the assigned requirements.
  - (C) **8 Points** — Provide accurate graphical and numerical documentation of time domain performance of the designed feedback control system, also in the case requirements are not satisfied.
  - (D) **2-4 Points** — Discuss problems on modal analysis and stability.
- **Bonus and points deduction**
  - (E) **2 Points** — Orderly presentation, clearly legible handwriting, clarity, ability to synthesize.
  - (F) **-3 Points** — A file (**Results_AC_Surname_StudentID.m**) with reported results must be returned to the teacher. If such a file is not delivered or is incomplete or is inconsistent with the results reported on the written examination papers, then there will be a -3 Points penalty. In order to spot possible syntax errors, the student may want to run the script.

All the details of student's solution must be reported on the written examination papers. Each step of the proposed solution must be properly discussed.

Reminder not to fail the exam — Given the main problem to solve in the Automatic Control written exam: *Translate given performance specifications into suitable parameters for the design of controller $G_c(s)$, that provides fulfillment of performance requirements, with the least possible number of poles at the origin and that is physically realizable,* the exam is failed if one of the following conditions occur:

- The system type is failed (that is, ν is different from the minimum value which guarantees fulfilment of steady-state requirements in the presence of polynomial references and/or polynomial disturbances).
- No controller is designed.
- The controller is not physically realizable, i.e., it is not causal.
- The designed controller does not even stabilize the feedback control system.
- Furthermore, since it is usually much easier and effortless to design a feedback control system with small bandwidth (that is, systems with large rise time), the exam is failed if the rise time of the controlled system is larger than twice the rise time specified by given requirements. For systems with rise time in the range $]t_r, 2t_r]$, proportional points deduction is applied.

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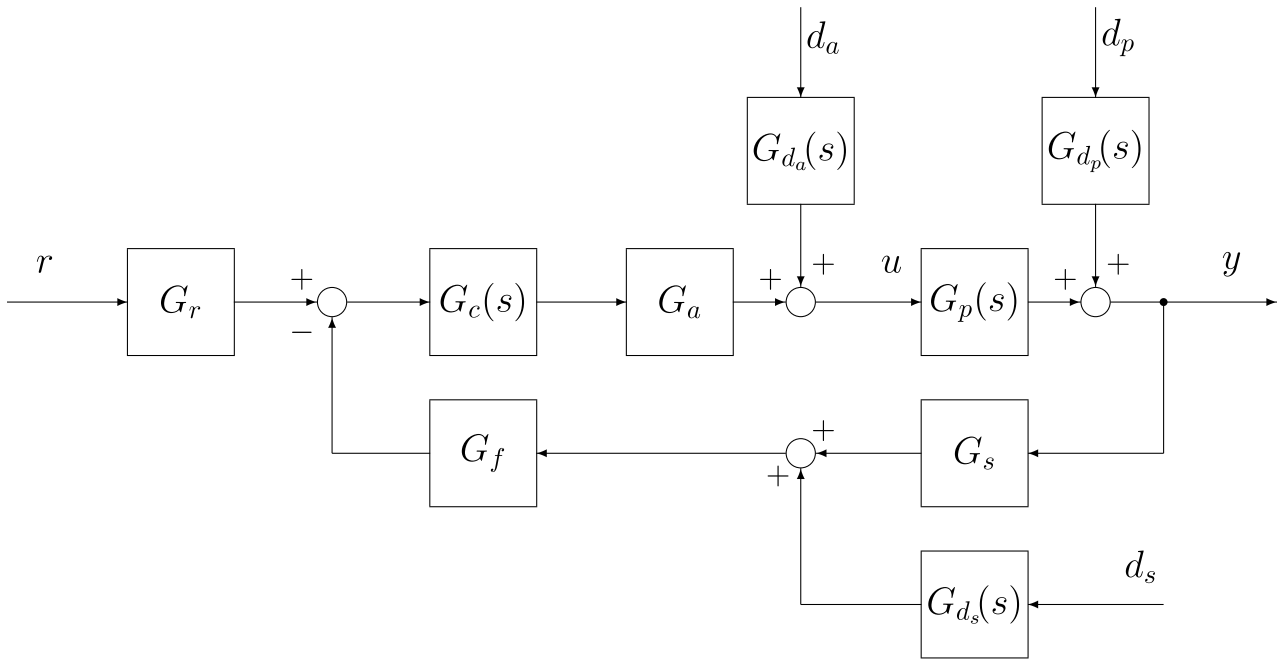
Automatic Control (05LSLQD, 05LSLNE)

Exam simulation no. 2

Consider the feedback control system below.



$$G_p(s) = \frac{40}{s^2 + 3s + 4.5}$$

$G_s = 1$
$G_a = -0.09$
$G_r = 1$
$G_{da}(s) = 1; \quad G_{dp}(s) = 1; \quad G_{ds}(s) = 1$
$d_a(t) = D_{a0};\ |\ D_{a0}\ | \leq 8.5 \cdot 10^{-3};$
$d_p(t) = D_{p0}t;\ |\ D_{p0}\ | \leq 3 \cdot 10^{-3};$
$d_s(t) = a_s \sin(\omega_s t), \quad |\ a_s\ | \leq 10^{-2},\ \ \omega_s \geq 50$ rad s^{-1}.

Specifications
(S1) Steady-state gain of the feedback control system: $K_d = 1$
(S2) Steady-state output error when the reference is a ramp $(R_0 = 1)$: $|\ e_r^\infty\ | \leq 3.5 \cdot 10^{-1}$
(S3) Steady-state output error in the presence of d_a: $|\ e_{d_a}^\infty\ | \leq 1.75 \cdot 10^{-2}$
(S4) Steady-state output error in the presence of d_p: $|\ e_{d_p}^\infty\ | \leq 1 \cdot 10^{-3}$
(S5) Steady-state output error in the presence of d_s: $|\ e_{d_s}^\infty\ | \leq 2 \cdot 10^{-4}$.
(S6) Rise time: $t_r \leq 2.5$ s
(S7) Settling time: $t_{s,\,5\%} \leq 10$ s
(S8) Step response overshoot: $\hat{s} \leq 8\%$

Design of controllers G_f and $G_c(s)$.

- **Part 1**

  (A) **10 Points**

  (A.1) Translate given performance specifications into suitable parameters for the design of controllers $G_c(s)$ and G_f, that provides fulfillment of performance requirements.

  (A.2) Discuss the sign of the generalized steady-state gain K_c for which the control system is stabilizable with dynamical networks (phase-lead and/or phase-lag).

- **Part 2**

  (B) **10 Points** — Design a controller that guarantees fulfillment of the assigned requirements.

  (C) **8 Points** — Provide accurate graphical and numerical documentation of time domain performance of the designed feedback control system, also in the case requirements are not satisfied.

  (D) **2-4 Points** — Discuss problems on modal analysis and stability.

- **Bonus and points deduction**

  (E) **2 Points** — Orderly presentation, clearly legible handwriting, clarity, ability to synthesize.

  (F) **-3 Points** — A file (**Results_AC_Surname_StudentID.m**) with reported results must be returned to the teacher. If such a file is not delivered or is incomplete or is inconsistent with the results reported on the written examination papers, then there will be a -3 Points penalty. In order to spot possible syntax errors, the student may want to run the script.

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- The controller is not physically realizable, i.e., it is not causal.
- The designed controller does not even stabilize the feedback control system.
- Furthermore, since it is usually much easier and effortless to design a feedback control system with small bandwidth (that is, systems with large rise time), the exam is failed if the rise time of the controlled system is larger than twice the rise time specified by given requirements. For systems with rise time in the range $]t_r, 2t_r]$, proportional points deduction is applied.

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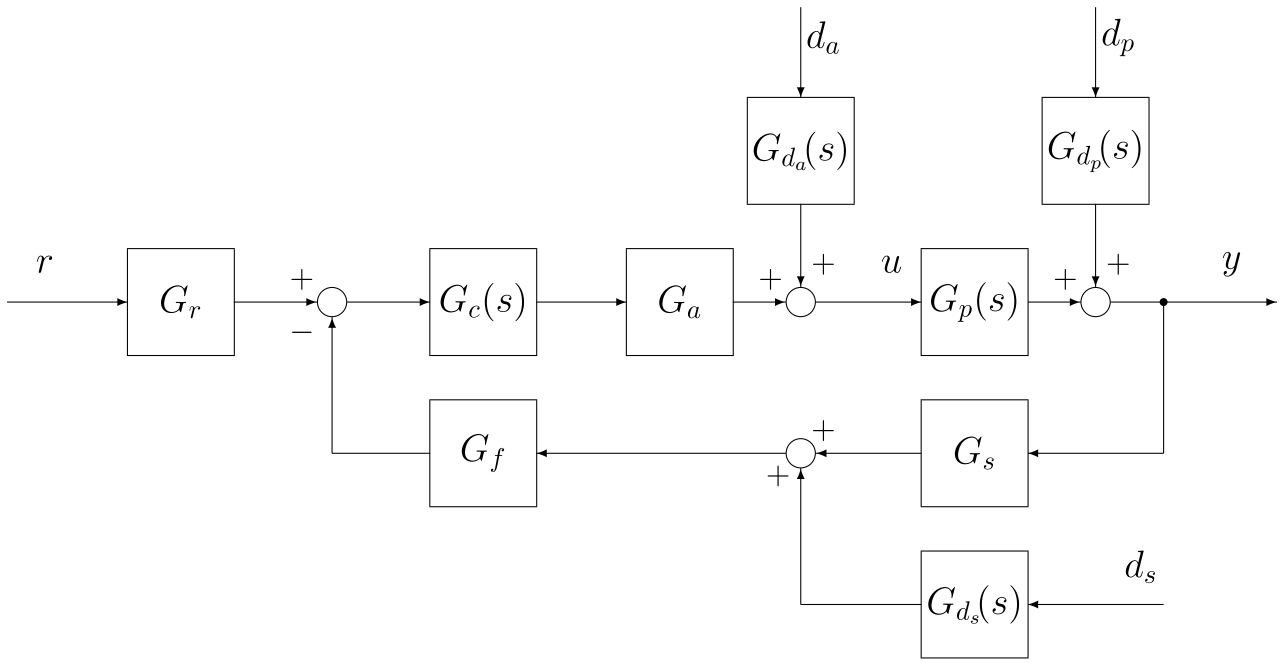
Exam simulation no. 3

Consider the feedback control system below.



$$G_p(s) = \frac{100}{s^2 + 5.5s + 4.5}$$

$G_s = 1$
$G_a = 0.014$
$G_r = 1$
$G_{da}(s) = 1; \quad G_{dp}(s) = 1; \quad G_{ds}(s) = 1$
$d_a(t) = D_{a0}; \mid D_{a0} \mid \leq 1.5 \cdot 10^{-3}$;
$d_p(t) = a_p \sin(\omega_p t), \quad \mid a_p \mid \leq 16 \cdot 10^{-2}, \ \omega_p \leq 0.03$ rad s^{-1}.
$d_s(t) = a_s \sin(\omega_s t), \quad \mid a_s \mid \leq 2 \cdot 10^{-1}, \ \omega_s \geq 60$ rad s^{-1}.

Specifications
(S1) Steady-state gain of the feedback control system: $K_d = 1$
(S2) Steady-state output error when the reference is a ramp $(R_0 = 1)$: $\mid e_r^\infty \mid \leq 1.5 \cdot 10^{-1}$
(S3) Steady-state output error in the presence of d_a: $\mid e_{d_a}^\infty \mid \leq 4.5 \cdot 10^{-3}$
(S4) Steady-state output error in the presence of d_p: $\mid e_{d_p}^\infty \mid \leq 2 \cdot 10^{-3}$.
(S5) Steady-state output error in the presence of d_s: $\mid e_{d_s}^\infty \mid \leq 8 \cdot 10^{-4}$.
(S6) Rise time: $t_r \leq 2$ s
(S7) Settling time: $t_{s,\,5\%} \leq 8$ s
(S8) Step response overshoot: $\hat{s} \leq 12\%$

Design of controllers G_f and $G_c(s)$.

- **Part 1**

  (A) **10 Points**

  (A.1) Translate given performance specifications into suitable parameters for the design of controllers $G_c(s)$ and G_f, that provides fulfillment of performance requirements.

  (A.2) Discuss the sign of the generalized steady-state gain K_c for which the control system is stabilizable with dynamical networks (phase-lead and/or phase-lag).

- **Part 2**

  (B) **10 Points** — Design a controller that guarantees fulfillment of the assigned requirements.

  (C) **8 Points** — Provide accurate graphical and numerical documentation of time domain performance of the designed feedback control system, also in the case requirements are not satisfied.

  (D) **2-4 Points** — Discuss problems on modal analysis and stability.

- **Bonus and points deduction**

  (E) **2 Points** — Orderly presentation, clearly legible handwriting, clarity, ability to synthesize.

  (F) **-3 Points** — A file (**Results_AC_Surname_StudentID.m**) with reported results must be returned to the teacher. If such a file is not delivered or is incomplete or is inconsistent with the results reported on the written examination papers, then there will be a -3 Points penalty. In order to spot possible syntax errors, the student may want to run the script.

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- The controller is not physically realizable, i.e., it is not causal.
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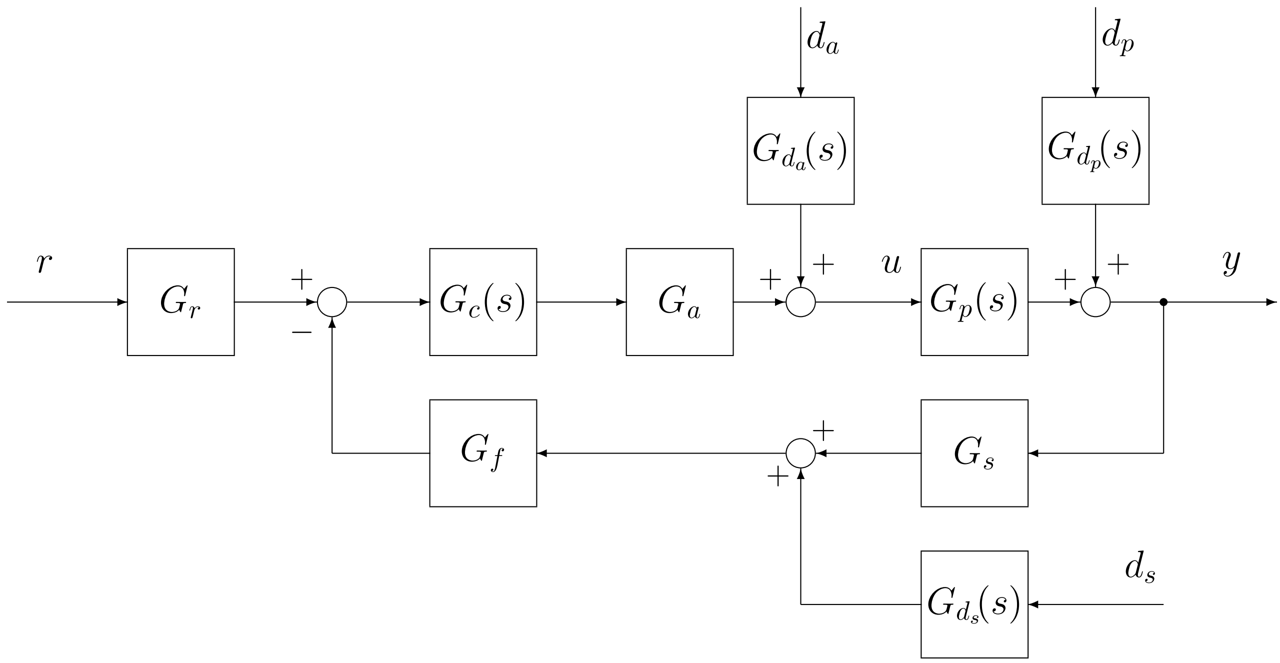
Exam simulation no. 4

Consider the feedback control system below.



$$G_p(s) = \frac{-30}{s^3 + 3s^2 + 2s}$$

$G_s = 1$
$G_a = 0.006$
$G_r = 1$
$G_{da}(s) = 1; \quad G_{dp}(s) = 1; \quad G_{ds}(s) = 1$
$d_a(t) = D_{a0};\ |\ D_{a0}\ | \leq 2.5 \cdot 10^{-3};$
$d_p(t) = D_{p0}t;\ |\ D_{p0}\ | \leq 8.5 \cdot 10^{-3};$
$d_s(t) = a_s \sin(\omega_s t), \quad |\ a_s\ | \leq 5 \cdot 10^{-2},\ \ \omega_s \geq 40$ rad s^{-1}.

Specifications
(S1) Steady-state gain of the feedback control system: $K_d = 1$
(S2) Steady-state output error when the reference is a ramp $(R_0 = 1)$: $|\ e_r^\infty\ | \leq 2.5 \cdot 10^{-1}$
(S3) Steady-state output error in the presence of d_a: $|\ e_{d_a}^\infty\ | \leq 1 \cdot 10^{-2}$
(S4) Steady-state output error in the presence of d_p: $|\ e_{d_p}^\infty\ | \leq 1.5 \cdot 10^{-3}$
(S5) Steady-state output error in the presence of d_s: $|\ e_{d_s}^\infty\ | \leq 5 \cdot 10^{-4}$.
(S6) Rise time: $t_r \leq 3.5$ s
(S7) Settling time: $t_{s,\,5\%} \leq 14$ s
(S8) Step response overshoot: $\hat{s} \leq 15\%$

Design of controllers G_f and $G_c(s)$.

- **Part 1**
  - (A) **10 Points**
    - (A.1) Translate given performance specifications into suitable parameters for the design of controllers $G_c(s)$ and G_f, that provides fulfillment of performance requirements.
    - (A.2) Discuss the sign of the generalized steady-state gain K_c for which the control system is stabilizable with dynamical networks (phase-lead and/or phase-lag).
- **Part 2**
  - (B) **10 Points** — Design a controller that guarantees fulfillment of the assigned requirements.
  - (C) **8 Points** — Provide accurate graphical and numerical documentation of time domain performance of the designed feedback control system, also in the case requirements are not satisfied.
  - (D) **2-4 Points** — Discuss problems on modal analysis and stability.
- **Bonus and points deduction**
  - (E) **2 Points** — Orderly presentation, clearly legible handwriting, clarity, ability to synthesize.
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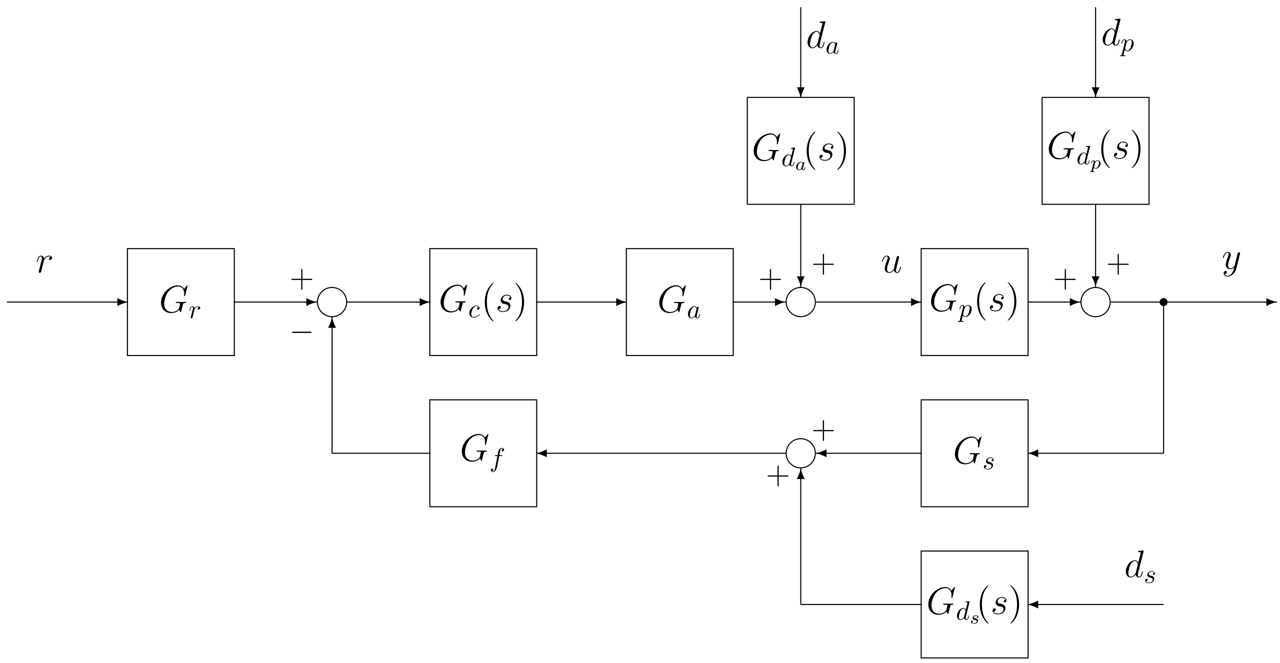
Exam simulation no. 5

Consider the feedback control system below.



$$G_p(s) = \frac{25}{s^3 + 3.3s^2 + 2s}$$

$G_s = 2$
$G_a = 0.38$
$G_r = 1$
$G_{da}(s) = 1; \quad G_{dp}(s) = 1; \quad G_{ds}(s) = 1$
$d_a(t) = D_{a0}t$; $\mid D_{a0} \mid \leq 5.5 \cdot 10^{-3}$;
$d_p(t) = a_p \sin(\omega_p t)$, $\quad \mid a_p \mid \leq 2 \cdot 10^{-2}, \;\; \omega_p \leq 0.02$ rad s^{-1}.
$d_s(t) = a_s \sin(\omega_s t)$, $\quad \mid a_s \mid \leq 10^{-1}, \;\; \omega_s \geq 40$ rad s^{-1}.

Specifications
(S1) Steady-state gain of the feedback control system: $K_d = 4$
(S2) Steady-state output error when the reference is a ramp $(R_0 = 1)$: $\mid e_r^\infty \mid < 1.5 \cdot 10^{-1}$
(S3) Steady-state output error in the presence of d_a: $\mid e_{d_a}^\infty \mid < 5.8$
(S4) Steady-state output error in the presence of d_p: $\mid e_{d_p}^\infty \mid < 3.6 \cdot 10^{-4}$.
(S5) Steady-state output error in the presence of d_s: $\mid e_{d_s}^\infty \mid < 1.25 \cdot 10^{-4}$.
(S6) Rise time: $t_r < 2.5$ s
(S7) Settling time: $t_{s,\,5\%} < 5$ s
(S8) Step response overshoot: $\hat{s} < 12\%$

Design of controllers G_f and $G_c(s)$.

- **Part 1**

  (A) **10 Points**

  (A.1) Translate given performance specifications into suitable parameters for the design of controllers $G_c(s)$ and G_f, that provides fulfillment of performance requirements.

  (A.2) Discuss the sign of the generalized steady-state gain K_c for which the control system is stabilizable with dynamical networks (phase-lead and/or phase-lag).

- **Part 2**

  (B) **10 Points** — Design a controller that guarantees fulfillment of the assigned requirements.

  (C) **8 Points** — Provide accurate graphical and numerical documentation of time domain performance of the designed feedback control system, also in the case requirements are not satisfied.

  (D) **2-4 Points** — Discuss problems on modal analysis and stability.

- **Bonus and points deduction**

  (E) **2 Points** — Orderly presentation, clearly legible handwriting, clarity, ability to synthesize.

  (F) **-3 Points** — A file (**Results_AC_Surname_StudentID.m**) with reported results must be returned to the teacher. If such a file is not delivered or is incomplete or is inconsistent with the results reported on the written examination papers, then there will be a -3 Points penalty. In order to spot possible syntax errors, the student may want to run the script.

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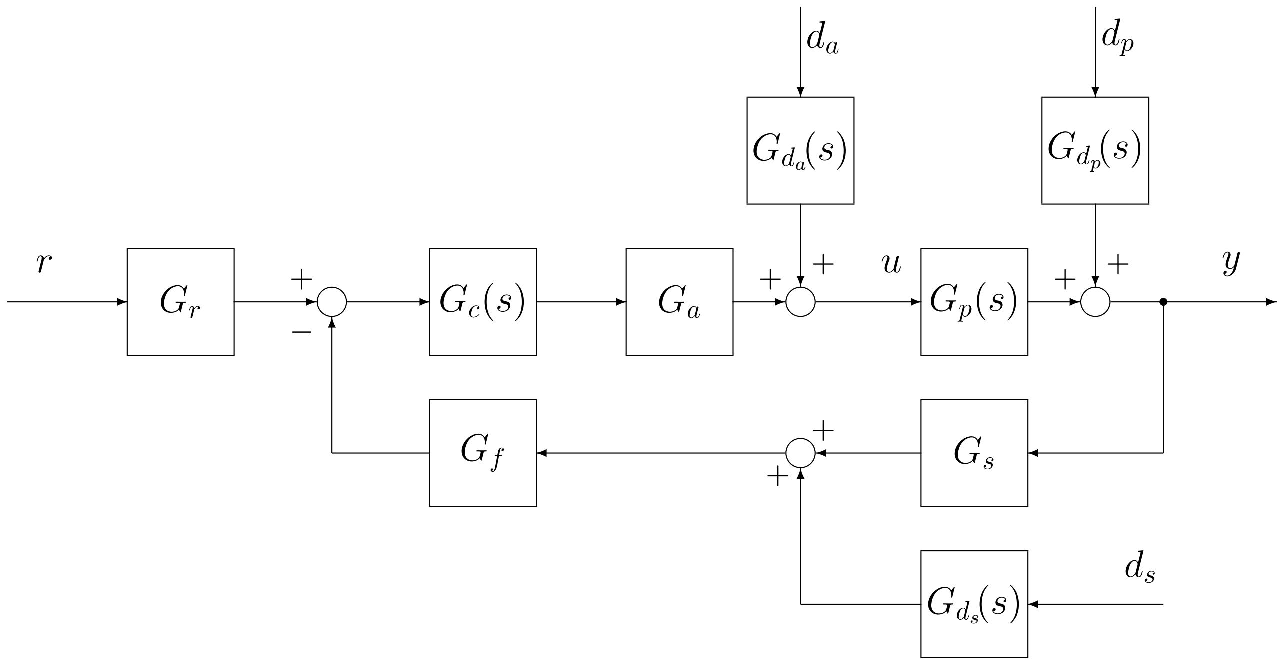
Exam simulation no. 6

Consider the feedback control system below.



$$G_p(s) = \frac{40}{s^3 + 3s^2 + 4.5s}$$

$G_s = 3$
$G_a = -0.27$
$G_r = 1$
$G_{da}(s) = 1; \quad G_{dp}(s) = 1; \quad G_{ds}(s) = 1$
$d_a(t) = D_{a0};\ | D_{a0} | \leq 8.5 \cdot 10^{-3};$
$d_p(t) = D_{p0}t^2;\ | D_{p0} | \leq 3 \cdot 10^{-3};$
$d_s(t) = a_s \sin(\omega_s t), \quad | a_s | \leq 10^{-2},\ \ \omega_s \geq 50$ rad s^{-1}.

Specifications
(S1) Steady-state gain of the feedback control system: $K_d = 3$
(S2) Steady-state output error when the reference is a ramp $(R_0 = 1)$: $| e_r^\infty | < 3.5 \cdot 10^{-1}$
(S3) Steady-state output error in the presence of d_a: $| e_{d_a}^\infty | < 1.75 \cdot 10^{-2}$
(S4) Steady-state output error in the presence of d_p: $| e_{d_p}^\infty | < 0.375$
(S5) Steady-state output error in the presence of d_s: $| e_{d_s}^\infty | < 3.3 \cdot 10^{-5}$.
(S6) Rise time: $t_r < 2.35$ s
(S7) Settling time: $t_{s,\,5\%} < 8$ s
(S8) Step response overshoot: $\hat{s} \leq 9\%$

Design of controllers G_f and $G_c(s)$.

- **Part 1**
  - (A) **10 Points**
    - (A.1) Translate given performance specifications into suitable parameters for the design of controllers $G_c(s)$ and G_f, that provides fulfillment of performance requirements.
    - (A.2) Discuss the sign of the generalized steady-state gain K_c for which the control system is stabilizable with dynamical networks (phase-lead and/or phase-lag).
- **Part 2**
  - (B) **10 Points** — Design a controller that guarantees fulfillment of the assigned requirements.
  - (C) **8 Points** — Provide accurate graphical and numerical documentation of time domain performance of the designed feedback control system, also in the case requirements are not satisfied.
  - (D) **2-4 Points** — Discuss problems on modal analysis and stability.
- **Bonus and points deduction**
  - (E) **2 Points** — Orderly presentation, clearly legible handwriting, clarity, ability to synthesize.
  - (F) **-3 Points** — A file (**Results_AC_Surname_StudentID.m**) with reported results must be returned to the teacher. If such a file is not delivered or is incomplete or is inconsistent with the results reported on the written examination papers, then there will be a -3 Points penalty. In order to spot possible syntax errors, the student may want to run the script.

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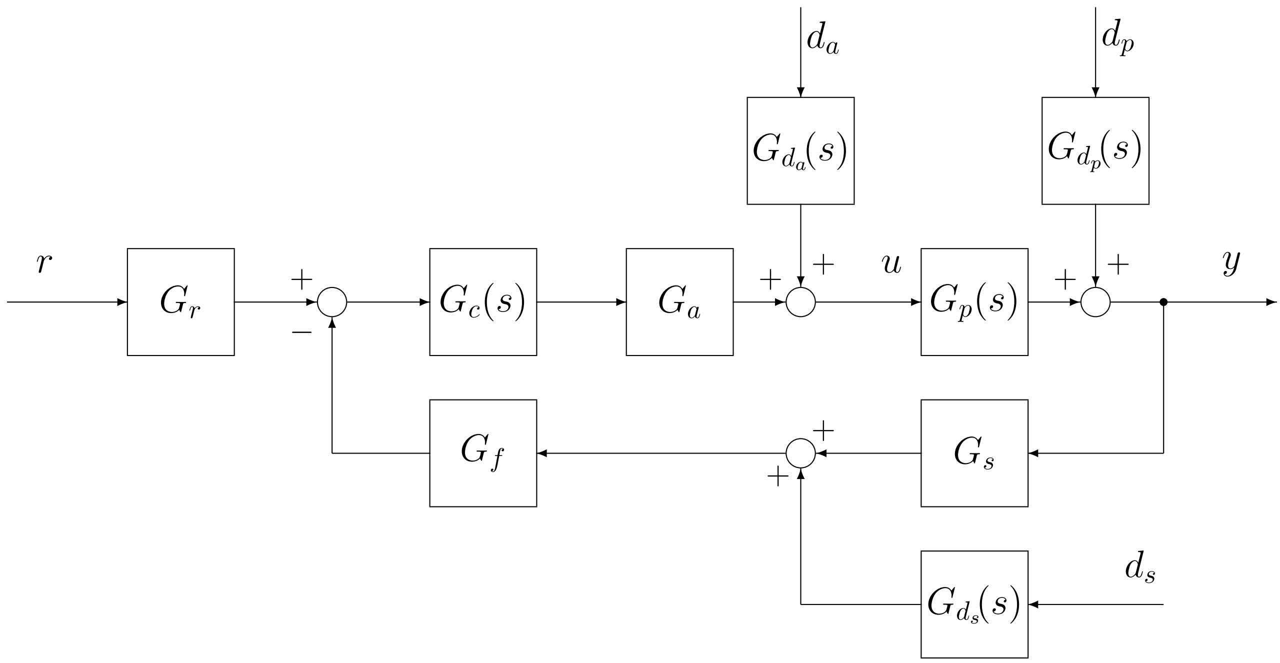
Exam simulation no. 7

Consider the feedback control system below.



$$G_p(s) = \frac{100}{s^3 + 5.5s^2 + 4.5s}$$

$G_s = 0.5$
$G_a = 0.112$
$G_r = 1$
$G_{da}(s) = 1; \quad G_{dp}(s) = 1; \quad G_{ds}(s) = 1$
$d_a(t) = D_{a0}t$; $\mid D_{a0} \mid \leq 1.5 \cdot 10^{-3}$;
$d_p(t) = a_p \sin(\omega_p t)$, $\quad \mid a_p \mid \leq 16 \cdot 10^{-2}, \;\; \omega_p \leq 0.03$ rad s^{-1}.
$d_s(t) = a_s \sin(\omega_s t)$, $\quad \mid a_s \mid \leq 2 \cdot 10^{-1}, \;\; \omega_s \geq 60$ rad s^{-1}.

Specifications
(S1) Steady-state gain of the feedback control system: $K_d = 8$
(S2) Steady-state output error when the reference is a ramp $(R_0 = 1)$: $\mid e_r^\infty \mid < 1.5 \cdot 10^{-1}$
(S3) Steady-state output error in the presence of d_a: $\mid e_{d_a}^\infty \mid < 2.14$
(S4) Steady-state output error in the presence of d_p: $\mid e_{d_p}^\infty \mid < 5.1 \cdot 10^{-3}$.
(S5) Steady-state output error in the presence of d_s: $\mid e_{d_s}^\infty \mid < 1.6 \cdot 10^{-3}$.
(S6) Rise time: $t_r < 1.8$ s
(S7) Settling time: $t_{s,\,5\%} < 6$ s
(S8) Step response overshoot: $\hat{s} < 13\%$

Design of controllers G_f and $G_c(s)$.

- **Part 1**

  (A) **10 Points**

  (A.1) Translate given performance specifications into suitable parameters for the design of controllers $G_c(s)$ and G_f, that provides fulfillment of performance requirements.

  (A.2) Discuss the sign of the generalized steady-state gain K_c for which the control system is stabilizable with dynamical networks (phase-lead and/or phase-lag).

- **Part 2**

  (B) **10 Points** — Design a controller that guarantees fulfillment of the assigned requirements.

  (C) **8 Points** — Provide accurate graphical and numerical documentation of time domain performance of the designed feedback control system, also in the case requirements are not satisfied.

  (D) **2-4 Points** — Discuss problems on modal analysis and stability.

- **Bonus and points deduction**

  (E) **2 Points** — Orderly presentation, clearly legible handwriting, clarity, ability to synthesize.

  (F) **-3 Points** — A file (**Results_AC_Surname_StudentID.m**) with reported results must be returned to the teacher. If such a file is not delivered or is incomplete or is inconsistent with the results reported on the written examination papers, then there will be a -3 Points penalty. In order to spot possible syntax errors, the student may want to run the script.

All the details of student's solution must be reported on the written examination papers. Each step of the proposed solution must be properly discussed.

Reminder not to fail the exam — Given the main problem to solve in the Automatic Control written exam: *Translate given performance specifications into suitable parameters for the design of controller $G_c(s)$, that provides fulfillment of performance requirements, with the least possible number of poles at the origin and that is physically realizable,* the exam is failed if one of the following conditions occur:

- The system type is failed (that is, ν is different from the minimum value which guarantees fulfilment of steady-state requirements in the presence of polynomial references and/or polynomial disturbances).

- No controller is designed.

- The controller is not physically realizable, i.e., it is not causal.

- The designed controller does not even stabilize the feedback control system.

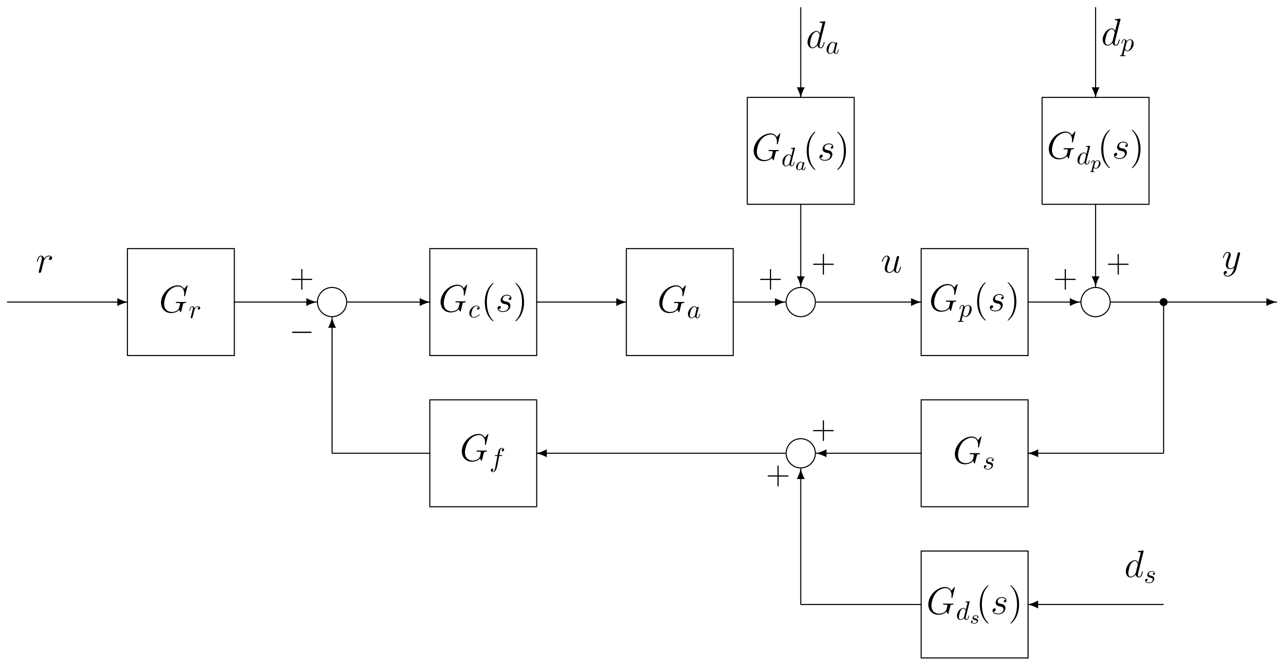
- Furthermore, since it is usually much easier and effortless to design a feedback control system with small bandwidth (that is, systems with large rise time), the exam is failed if the rise time of the controlled system is larger than twice the rise time specified by given requirements. For systems with rise time in the range $]t_r, 2t_r]$, proportional points deduction is applied.

Master of science-level in Mechanical Engineering
Academic Year 2019-2020, Second Semester

Automatic Control (05LSLQD, 05LSLNE)

Exam simulation no. 8

Consider the feedback control system below.



$$G_p(s) = \frac{-30}{s^3 + 3s^2 + 2s}$$

$G_s = 10$
$G_a = 0.06$
$G_r = 1$
$G_{da}(s) = 1; \quad G_{dp}(s) = 1; \quad G_{ds}(s) = 1$
$d_a(t) = D_{a0};\ |\ D_{a0}\ | \leq 2.5 \cdot 10^{-3};$
$d_p(t) = D_{p0}t^2;\ |\ D_{p0}\ | \leq 8.5 \cdot 10^{-3};$
$d_s(t) = a_s \sin(\omega_s t), \quad |\ a_s\ | \leq 5 \cdot 10^{-2},\ \ \omega_s \geq 40$ rad s^{-1}.

Specifications
(S1) Steady-state gain of the feedback control system: $K_d = 10$
(S2) Steady-state output error when the reference is a ramp $(R_0 = 1)$: $|\ e_r^\infty\ | < 2.5 \cdot 10^{-1}$
(S3) Steady-state output error in the presence of d_a: $|\ e_{d_a}^\infty\ | < 1 \cdot 10^{-2}$
(S4) Steady-state output error in the presence of d_p: $|\ e_{d_p}^\infty\ | < 0.94$
(S5) Steady-state output error in the presence of d_s: $|\ e_{d_s}^\infty\ | < 1.6 \cdot 10^{-5}$.
(S6) Rise time: $t_r < 2.5$ s
(S7) Settling time: $t_{s,\,5\%} < 13$ s
(S8) Step response overshoot: $\hat{s} < 14\%$

Design of controllers G_f and $G_c(s)$.

- **Part 1**
  - (A) **10 Points**
    - (A.1) Translate given performance specifications into suitable parameters for the design of controllers $G_c(s)$ and G_f, that provides fulfillment of performance requirements.
    - (A.2) Discuss the sign of the generalized steady-state gain K_c for which the control system is stabilizable with dynamical networks (phase-lead and/or phase-lag).
- **Part 2**
  - (B) **10 Points** — Design a controller that guarantees fulfillment of the assigned requirements.
  - (C) **8 Points** — Provide accurate graphical and numerical documentation of time domain performance of the designed feedback control system, also in the case requirements are not satisfied.
  - (D) **2-4 Points** — Discuss problems on modal analysis and stability.
- **Bonus and points deduction**
  - (E) **2 Points** — Orderly presentation, clearly legible handwriting, clarity, ability to synthesize.
  - (F) **-3 Points** — A file (**Results_AC_Surname_StudentID.m**) with reported results must be returned to the teacher. If such a file is not delivered or is incomplete or is inconsistent with the results reported on the written examination papers, then there will be a -3 Points penalty. In order to spot possible syntax errors, the student may want to run the script.

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