ELEC-E8116 Model-based control systems

Intermediate exam 1. 14.2.2017

- *Write the name of the course, your name, your study program, and student number to each answer sheet.*
- *There are three (3) problems and each one must be answered.*
- *No literature is allowed. A function calculator can be used.*

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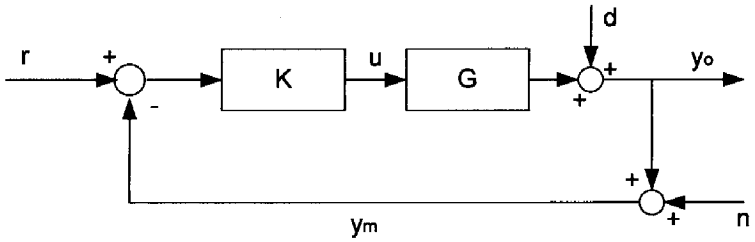
1. Explain briefly the following concepts

   - Singular value decomposition and singular values
   - Conservative control law
   - Robust performance
   - Spectral density and intensity (in stochastic continuous time systems)
   - "Push through"-rule

2. Consider a multivariable control configuration.



Write the equations describing the system and identify

   a. the closed loop transfer function
   b. the sensitivity function
   c. the complementary sensitivity function. Show that $S + T = I$ and explain the result.

Derive the equation for the error $e = r\text{-}y_0$. What are the requirements for the transfer functions in a-c in order that the system would perform well?

3. Find the poles, zeros and a minimal realization to the system

$$G(s) = \begin{bmatrix} \dfrac{2}{s+1} & \dfrac{2s-3}{(s+1)(s+2)} \\ \dfrac{s-2}{s+1} & \dfrac{s}{s+2} \end{bmatrix}$$