

## ELEC-E8116 Model-based control systems

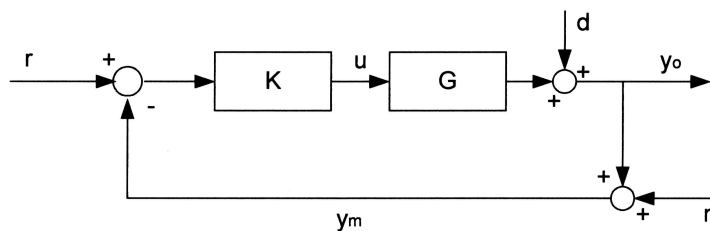
### Intermediate exam 1. 14.2.2017

- 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.

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

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

Derive the equation for the error  $e = r - y_o$ . 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

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