Modelling and control summaries

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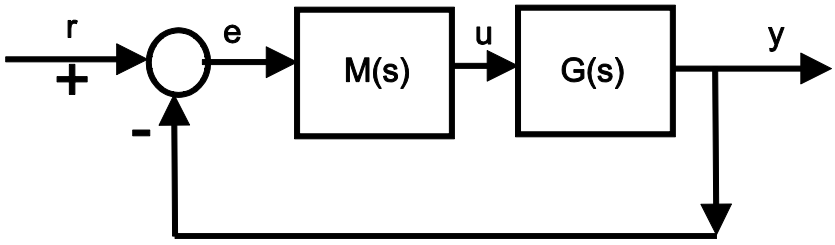
Simple feedback 1: Introduction

This brief summary assumes readers are familiar with the concept of feedback and block diagrams. For simplicity the focus is on the simplest form of block diagram, although it is relatively straightforward to extend the concepts to more complex arrangements. Hence consider a process *G(s)* and a compensator *M(s)* which is expressed as a gain K multiplied by a transfer function. The closed-loop transfer function is $G_c(s)$.



$$G_c = \frac{GM}{1+GM}$$

CHAPTER AIM

We want a systematic method for designing M(s) to give desirable behaviour. In order to do this it is necessary to quantify how good behaviour is defined. Much of this is discussed in detail in other sections so here just a brief summary is given. Typical closed-loop characteristics to be considered are listed next.

- Stability (all poles in LHP)
- Speed of response/rise time (how quickly does output get close to target)
- Settling time (How long before output remains close to target – close taken as 2-5%)
- Damping (Does system exhibit significant oscillation and overshoot – ideally damping >0.7)
- Offset (Is there a steady-state offset and if so how big is it?)
- Input activity (Does the control law give over actuation causing fatigue or sensible input use?)
- Constraints (do the nominal trajectories violate any constraints such as input/output limits?)

CORE SKILLS

- Understanding LHP/RHP and links between pole positions and behaviour – in section on behaviours.
- Discussions of settling time and overshoot/damping are in the same section.
- A separate section focusses entirely on offset.
- The block diagram section shows how to compute closed-loop transfer functions.

The skills above will be used to define a simple algorithm for designing a PI compensator.