Modelling and control summaries

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MATLAB GUIs – DC servo position control

ASSUMPTION: Students should understand the context of position control with a simple DC servo.

The dependence of the angular position θ of a DC servo on an input voltage v can be approximated by a 2nd order model of the form:

$$\frac{d^2\theta}{dt^2} + a\frac{d\theta}{dt} + b\theta = cv$$

The virtual laboratory here translates the angular position θ to a linear displacement x through a gear, but otherwise an equivalent model is valid.

The aim is to move an artefact to a specific position – this could represent a robotic arm, a printer jet or something similar.
Here, to add some fun, the artefact is a man (the stig) on a seat who needs to be positioned correctly. A simple control law is given as:

$$v = K_p(r-x) + K_I\int(r-x)dt$$

The GUI allows the user to investigate the efficacy of PI tuning parameters for a 2nd order model. For convenience, the model parameters are fixed so the position of the man in a seat is governed by an over damped 2nd order ODE:

$$\frac{d^2\theta}{dt^2} + 3\frac{d\theta}{dt} + \theta = 2v$$

ILLUSTRATIONS – the simulation runs fast compared to real time and users will see the stig moving towards the target position.

FILENAMES are thestig.p, thestig.fig (both are needed)