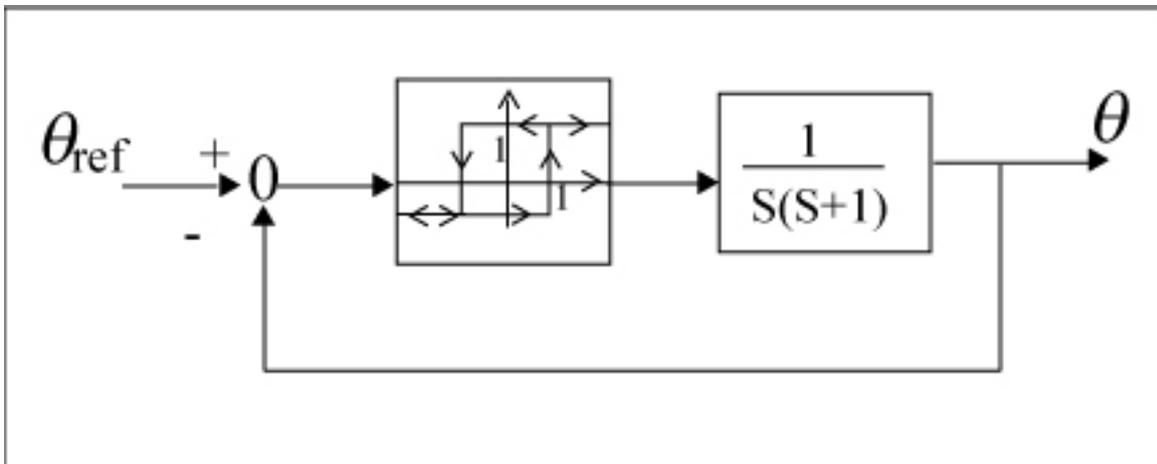


# Homework 7

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1. Consider the Feedback system shown in Figure 1. It consists of a toggle switch mounted in series with an electric motor. This system was studied in class, and it was shown it exhibits limit cycling behavior.
  - (a) Using describing function calculations, compute an estimate of the amplitude and frequency of the limit cycle for  $\theta_{ref} = 0$ .
  - (b) Build a simulation of this system: What are the true amplitude and frequency of the limit cycle? How far off were your predictions?
  - (c)  $\theta_{ref}$  now changes from 0 to 30 degrees. Plot the step response of the feedback system. What are the new characteristics of the limit cycle (amplitude, frequency?)



2. Gelb & Vander Velde, Problem 2.8
3. Gelb & Vander Velde, Problem 2.10
4. Gelb & Vander Velde, Problem 3.3