5ELEN018W - Robotic Principles
Lecture 6: Control - Part 1

Dr Dimitris C. Dracopoulos

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- Decision while driving affect (control) the next position and the final location
- Control theory is a big area used not only in engineering and robotics, but in computer science
- Can be seen as what is <u>the best next action to take</u> (given a specific state) so as to <u>achieve (optimise) specific objectives!</u>

Actuators (Motors)

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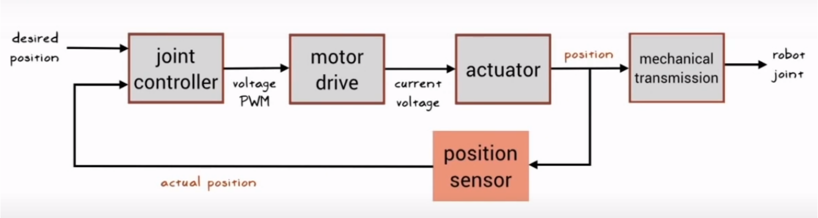
- Electric (using current)

Components of a Robot Joint Control System



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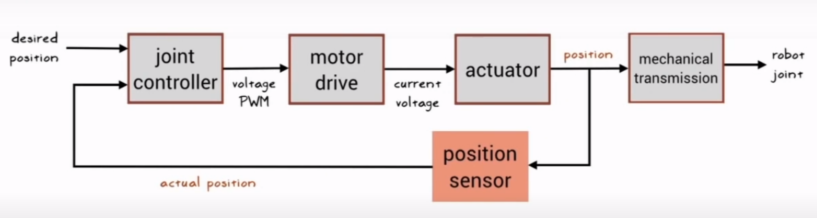

The dynamic system that is to be controlled is called the **plant**.

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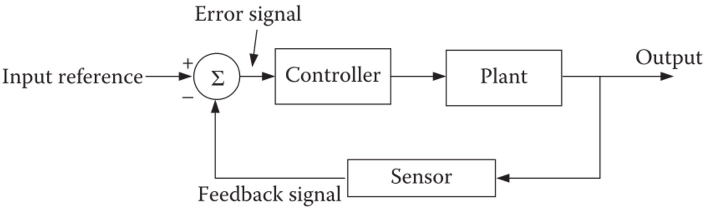
Block diagram of closed-loop control system:



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the desired joint position of a multi-joint robot is $\theta_d(t)$ and the actual joint position is $\theta(t)$, then the joint error is:

$$\theta_e = \theta_d(t) - \theta(t) \tag{1}$$

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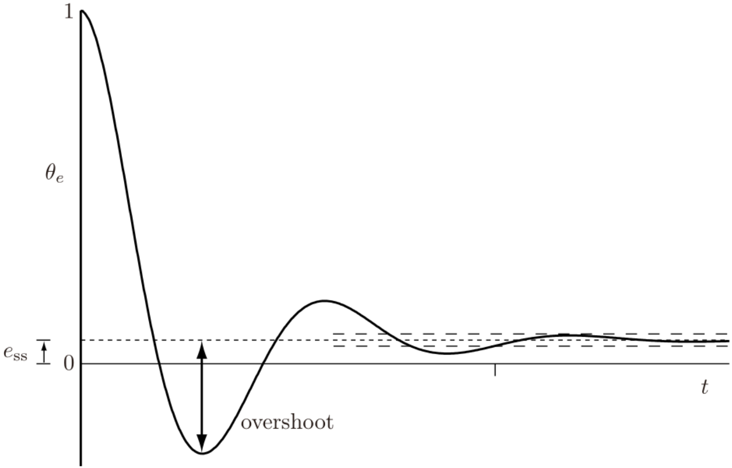

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- stability: a steady state error is achieved (no oscillations)

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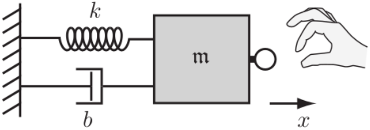

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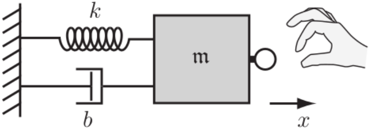

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- *tissue* $\longrightarrow$ spring

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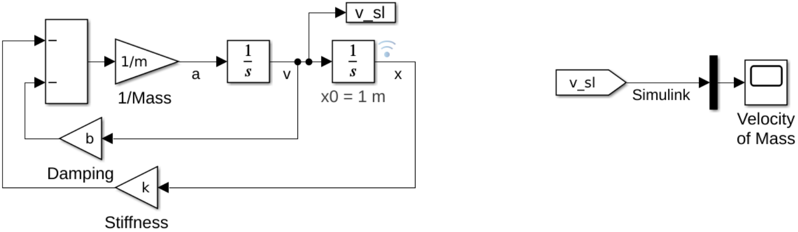
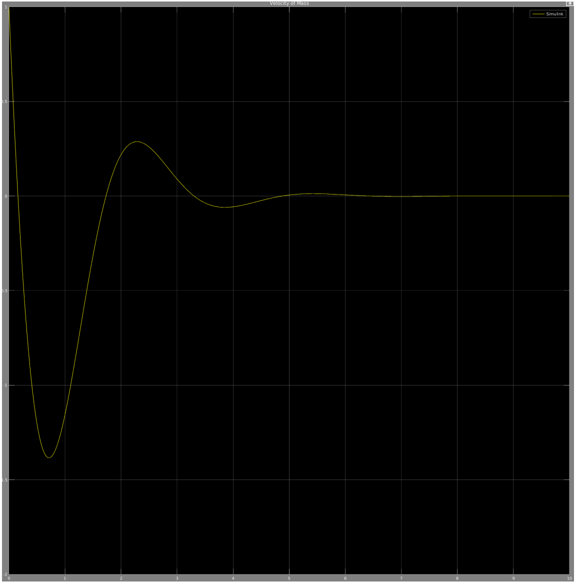
- One can solve for s, called the *poles* of the system
- The poles define the response (position) of the system as a function of time

Simulink Model of the Surgical Robot



Running the Simulink Model



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A common robot control strategy for manipulators:

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- The parameters changed are done in a way so that they can control the different size motors attached to each joint.

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Not possible to linearise complex dynamic systems!