

# EENG307: Time Response of First Order Systems<sup>1</sup>

## Lecture 10

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Fall 2022

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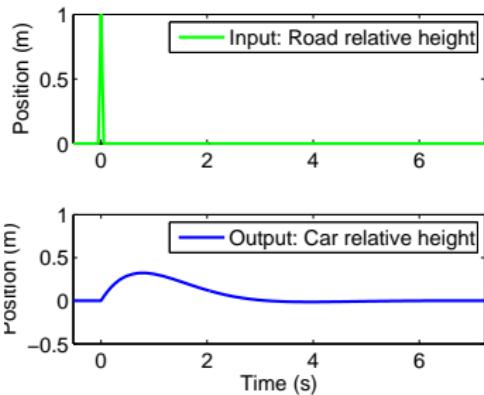
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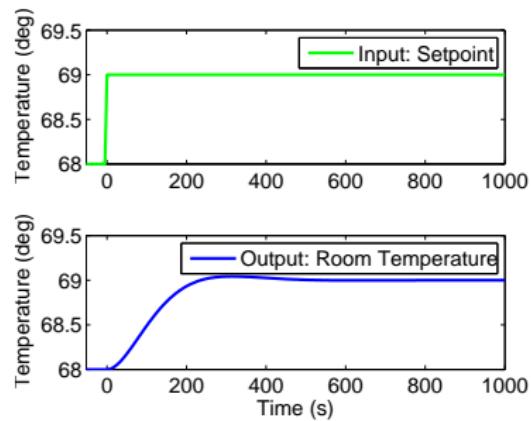
# Suspension Impulse Response



source:  
[http://upload.wikimedia.org/wikipedia/commons/5/5b/Porsche\\_911SC\\_Slantnose\\_1982\\_2.jpg](http://upload.wikimedia.org/wikipedia/commons/5/5b/Porsche_911SC_Slantnose_1982_2.jpg)



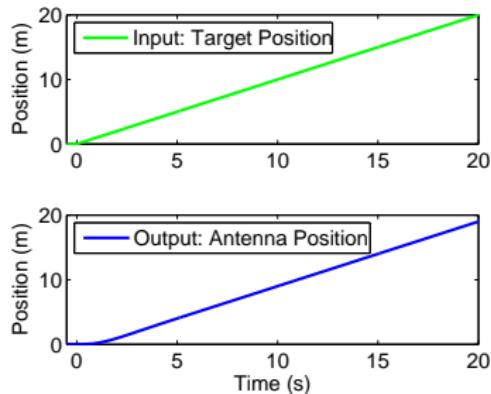
# Temperature Regulator Response



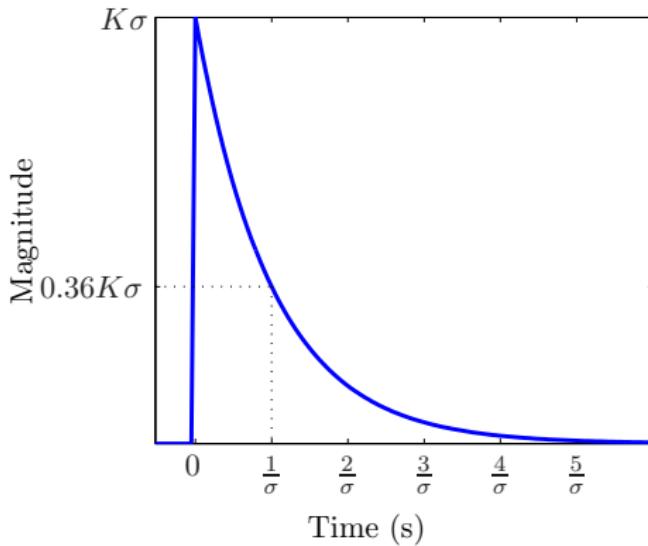
# Tracking Response



Source:  
[http://commons.wikimedia.org/wiki/File:C-band\\_Radar-dish\\_Antenna.jpg](http://commons.wikimedia.org/wiki/File:C-band_Radar-dish_Antenna.jpg)



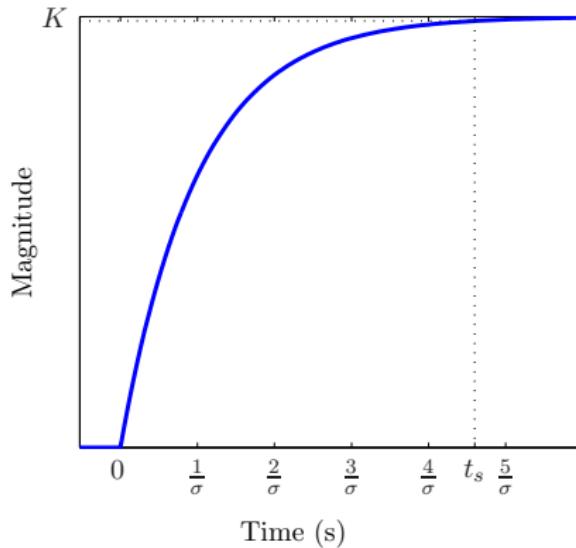
# Impulse Response Plot



## Definition

The *time constant* of a first order system is  $\tau = \frac{1}{\sigma}$ , and is the time for the impulse response - the magnitude of the output signal in response to an impulse input - to decay by 64%.

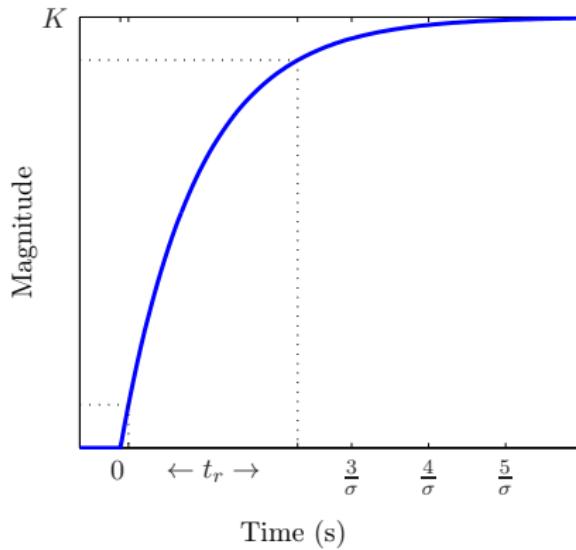
# Step Response Settling Time



## Definition

The step response *settling time* is the time for the step response - the magnitude of the output signal in response to a step input - to go reach within 1% of the final value, and for a first order system  $t_s = \frac{4.6}{\sigma}$

# Step Response Rise Time



## Definition

The step response *rise time* is the time for the step response to go from 10% to 90% of its final value, and for a first order system  $t_r = \frac{2.2}{\sigma}$