

# EENG307: System Identification<sup>1</sup>

## Lecture 23

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<sup>2</sup> Developed and edited by Tyrone Vincent and Kathryn Johnson, Colorado School of Mines, with contributions from Salman Mohagheghi, Chris Coulston, Kevin Moore, CSM and Matt Kupilik, University of Alaska, Anchorage

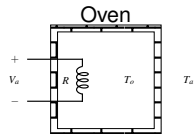
## Model Structure

## Transfer Function

## Example System

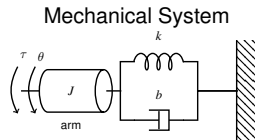
First order system

$$K \frac{\sigma}{s + \sigma}$$



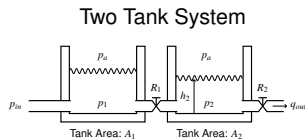
Second order system, under-damped

$$K \frac{\omega_n^2}{s^2 + 2\zeta\omega_n s + \omega_n^2}$$

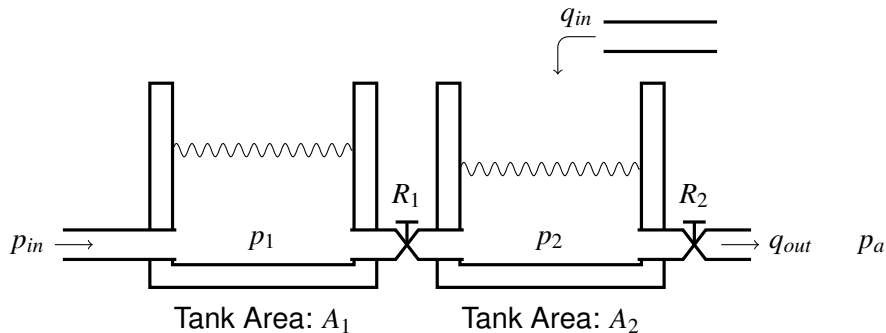


Second order system, over-damped

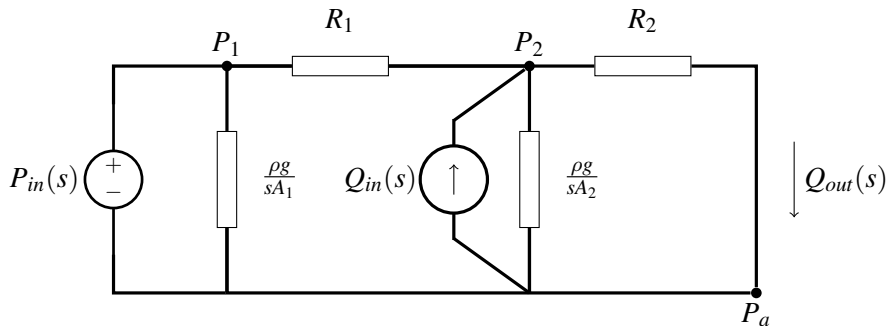
$$K \frac{\sigma_1 \sigma_2}{(s + \sigma_1)(s + \sigma_2)}$$



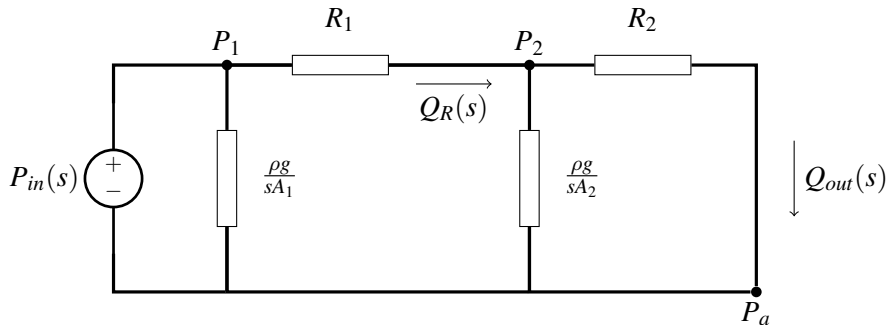
# Fluid System Diagram



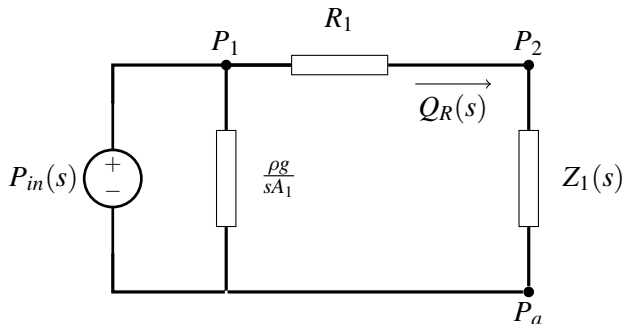
# Fluid System Impedance Network



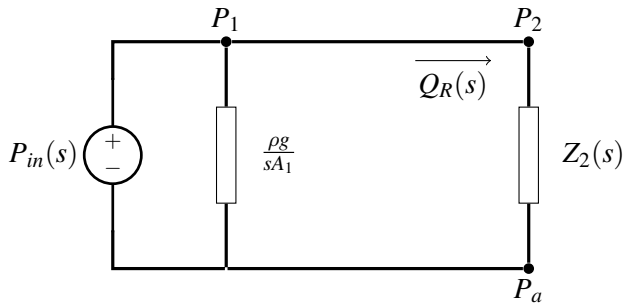
# Impedance Network for $P_{in}$ Input



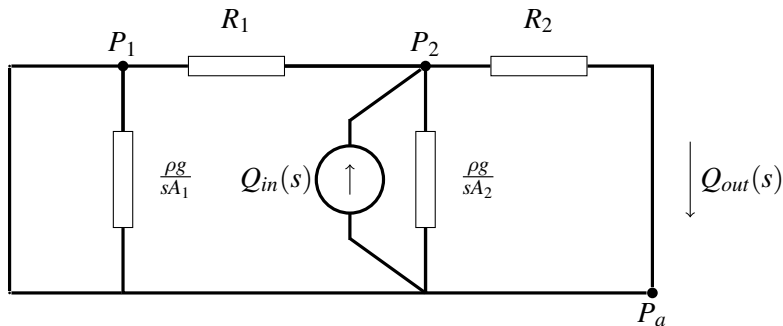
# Impedance Network for $P_{in}$ Input - Step 2



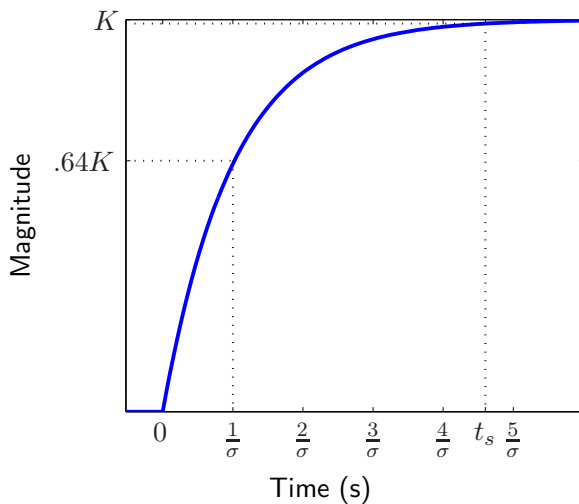
# Impedance Network for $P_{in}$ Input - Step 3



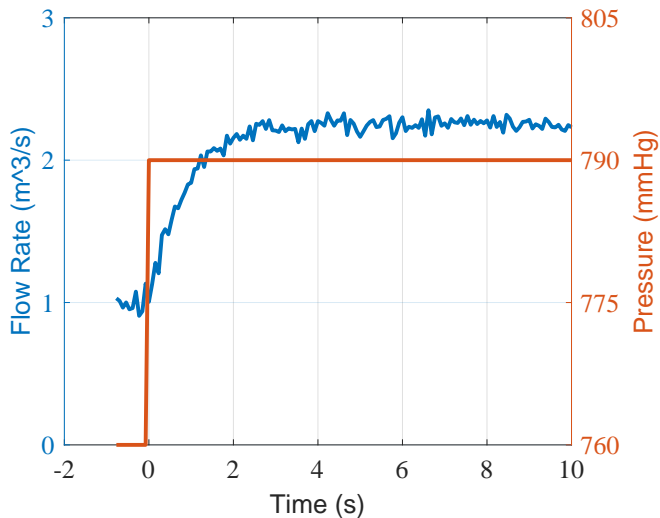
# Impedance Network for $Q_{in}$ Input



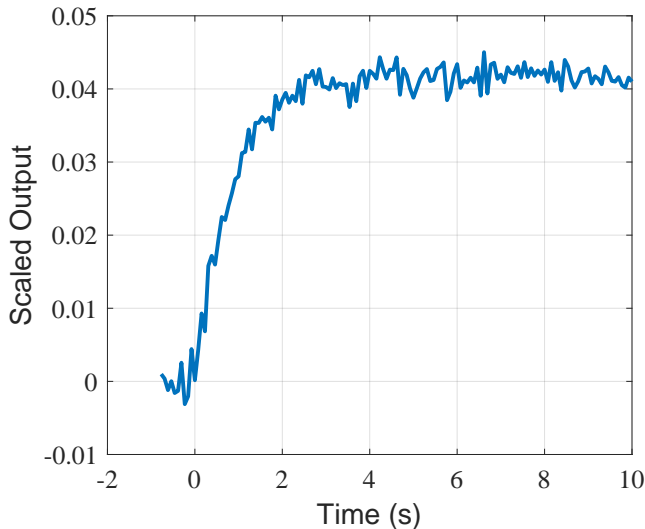
# Unit Step Response Plot - First order system



# Pressure and Flow Experiment



# Scaled Tank Experiment - Unit Step Response



# Unit Step Response Plot - Second Order System

