

Mathematical Analysis and Systems Theory

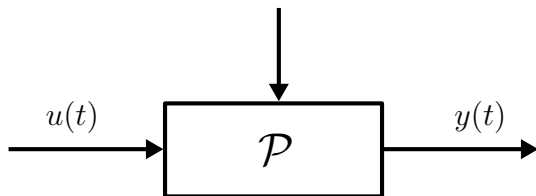
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Mathematical Systems Theory and Control



Mathematical control theory studies differential equations

$$\begin{aligned}\frac{d}{dt}x(t) &= Ax(t) + Bu(t), & x(0) &= x_0 \\ y(t) &= Cx(t)\end{aligned}$$

where

- $u(t) \in \mathbb{C}$ is the control input
- $y(t) \in \mathbb{C}$ is the measured output.

Key Focus Areas:

- Control of temperature and fluid flows
- Control of vibrating and flexible systems
- Dynamics of large-scale systems
- Modern mathematical techniques in control

Example: Robust Trajectory Tracking for Heat Equations

Objective: Control the system in such a way that the temperature measurements converge to reference trajectories.

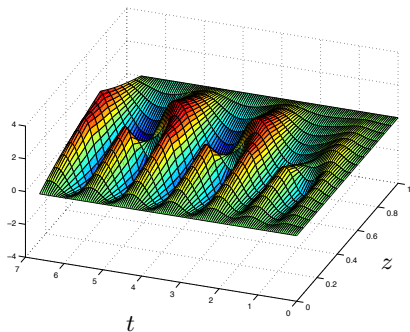


Figure: Controlled heat profile

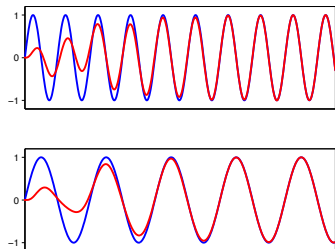
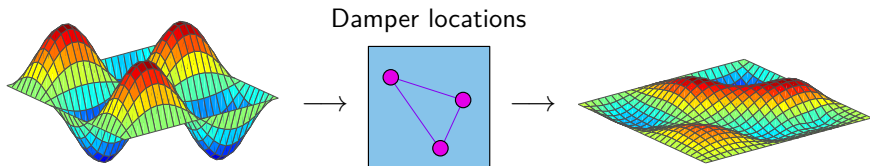


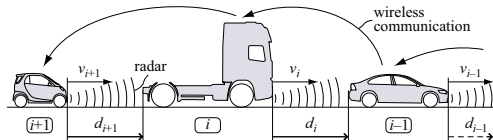
Figure: Measurements

Example: Optimal Disturbance Rejection

Objective: Choose locations of active dampers so that the structural vibrations are suppressed as efficiently as possible.



Example: Dynamics of Large Vehicle Formations



Source: Ploeg *et. al.*, '11.



Source: TED/R. D'Andrea

Research Group at TUT

Lassi Paunonen	Assistant Professor
Dmytro Baidiuk	Postdoctoral Researcher
Duy Phan-Duc	Postdoctoral Researcher
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Find out more!

`sysgrouptampere.wordpress.com`

`lassipaunonen.wordpress.com`

Youtube: Sysgroup Tampere

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