A short Introduction to Sliding Mode Control

Robust Control for Nonlinear Systems

Dr. Rainer Nitsche[1]

[1]Dept. Robotics
System Design Group

Control Methods in Robotics, August 2021

FESTO

Sliding Mode Objectives

Objecitves of this class of nonlinear control?

- Robustness versus uncetrainties / perturbations
- Finite time convergence towards the control objectives

FESTO

Sliding Mode Objectives

Objecitves of this class of nonlinear control?

- Robustness versus uncetrainties / perturbations
- Finite time convergence towards the control objectives

Features for this class of control?

- Discontinuous control law
- For standard sliding mode (first order): chattering effect, robustness
- For higher order sliding mode: accuracy, finite time convergence, robustness

FESTO

Sliding Mode Objectives

Objecitves of this class of nonlinear control?

- Robustness versus uncetrainties / perturbations
- Finite time convergence towards the control objectives

Features for this class of control?

- Discontinuous control law
- For standard sliding mode (first order): chattering effect, robustness
- For higher order sliding mode: accuracy, finite time convergence, robustness

Remark

Sliding mode as a phenomenon may appear in a dynamic system governed by ordinary differential equation with *discontinuous right hand side*

FESTO

Some Remarks on SMC

This is a text in second frame. For the sake of showing an example.

- Text visible on slide 1

FESTO

Some Remarks on SMC

This is a text in second frame. For the sake of showing an example.

- Text visible on slide 1
- Text visible on slide 2

FESTO

Some Remarks on SMC

This is a text in second frame. For the sake of showing an example.

- Text visible on slide 1
- Text visible on slide 2
- Text visible on slide 3

FESTO

Some Remarks on SMC

This is a text in second frame. For the sake of showing an example.

- Text visible on slide 1
- Text visible on slide 2

- Text visible on slide 4

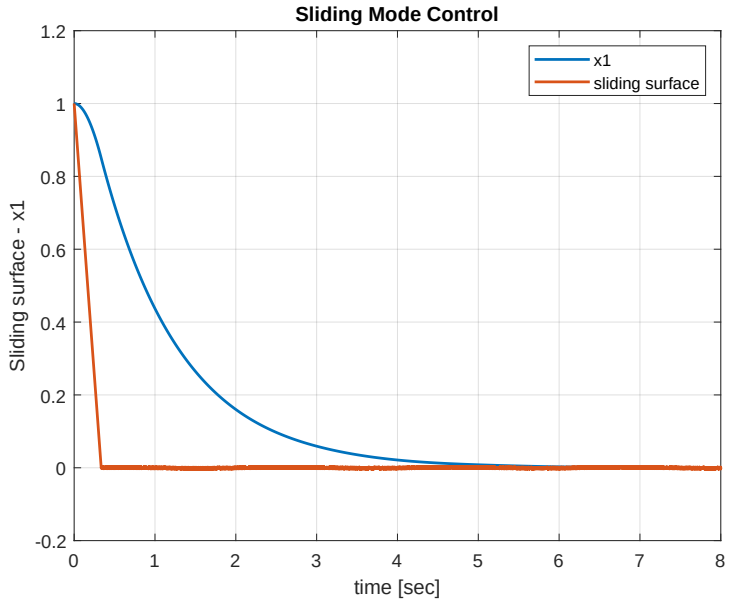
A motivating Example for SMC

This example is taken from [1].

Example

Sliding mode of the system:

$$\ddot{x} = \sin(3t) + u \qquad (1)$$



Sample frame title

In this slide, some important text will be highlighted because it's important. Please, don't abuse it.

Remark

Sample text

Important theorem

Sample text in red box

Examples

Sample text in green box. The title of the block is "Examples".

FESTO

References

[1] Vadim I. Utkin et al. *Road map for sliding mode control design*. 6330 Cham, Switzerland: Springer, 2020. ISBN: 978-3030417086. DOI: 10.1007/978-3-030-41709-3.