Discrete-Time Higher-Order Sliding Mode Control

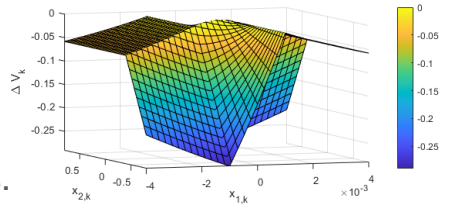
Sliding mode controllers are robust nonlinear controllers. They utilize the sign of the control error to achieve robustness with respect to disturbances in the plant. However, the discrete-time implementation of sliding mode control is challenging, due to the discontinuity (”jumps between -1 and 1”) of the control signal when the error is zero. With conventional discretization methods this leads to so-called discretization chattering. New discretization methods like the implicit discretization avoid this type of chattering.

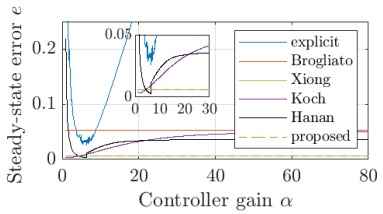
Super-twisting control, a second-order sliding mode algorithm, is an extension of first-order sliding mode control. One advantage is that the resulting control signal is continuous. The idea of super-twisting control can be extended to higher orders. A potential of this extension is the reduction of the remaining control error in discrete time. The goal of this project is the development of this new class of sliding mode controllers.

Will the new controller class help to solve some problems around discrete-time sliding mode control?

Within the thesis you will:

- Work in an active field of research.
- Gain understanding of nonlinear control methods.
- Develop a new class of sliding mode controllers.
- Properly realize these controllers in discrete-time.





Super-twisting control: $u = -\alpha \operatorname{sign}(x)\sqrt{|x|} + v$

$\dot{x} = u + \varphi, |\dot{\varphi}| \leq L \qquad \dot{v} = -\beta \operatorname{sign}(x)$

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