

Public Europe/Budapest T. Haba

GPU Day 2023

15–16 May 2023
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kacskovics.balazs@wig...
szigetibalazs@wigner.hu

GPU accelerated parallel computing of iterated function systems in mechatronic applications

16 May 2023, 16:00

30m

Wigner Datacenter - Wigner Research Centre for Physics

Lecture

Session VIII

Speaker

Tamás Haba

Description

Position control is a fundamental task of mechatronics, where the goal is to drive an object to a desired position or maintain its trajectory on a given path. The digital implementation of control leads to a sampled-data system, resulting in piecewise smooth dynamical properties due to the sudden changes of the control input at the sampling instants. In the controlled mechanical system, dry friction causes another nonsmooth effect because the Coulomb-friction force has a jump discontinuity at motion reversals. These two phenomena appear simultaneously in a mechatronic system; however, the sampling and friction-caused switchings are independent, making the analysis difficult.

In this work, the position control of a single-degree-of-freedom (1DoF) system in presence of friction is presented with an iterated function system (IFS) based approach. An IFS consists of a finite number of mappings on a metric space primarily used to describe fractals. We present that the discrete-time model of the discussed 1DoF nonsmooth system can be transformed into an IFS on the system's state space.

The numeric evaluation of the IFS can be challenging because a large set of initial states must be examined to describe the system accurately. To address this problem, we present a GPU-based simulation implemented in OpenCL to parallelize the function evaluations.

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Primary authors

Tamás Haba

Csaba Budai

Presentation materials

There are no materials yet.