
Max-plus switching systems and long max-plus matrix products

A Data Management Plan created using DMPonline

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Project abstract:

Switching max-plus linear (SMPL) systems are used to model the propagation of delays in a railway network.

Suppose that departure times of a network at a particular instant are given by a vector $x(k)$. The departure times at instant k are given by a recurrence relation based upon the departure times at a previous instant multiplied in the sense of max-plus arithmetic by matrix $A(u(k))$ where $u(k)$ is a control variable. At every instant, the network may slightly change, which is encapsulated in this control variable. This has a residual effect on the ultimate departure times, which one often seeks to optimize in some way: for instance, by minimizing the cumulative delay with respect to a given regular schedule.

The main idea of the proposed research is to study the switching max-plus linear systems as vector orbits of a finitely generated max-plus matrix semigroup: the set of all possible max-plus matrix products of a given finite set of matrices.

In this research we will be particularly interested in the long max-plus matrix products and developing for them an analogue of the CSR representation of max-plus matrix powers suggested by Sergeev and Schneider. We then aim to apply the new theoretical results which we obtain to switching max-plus systems and the above mentioned optimization problems over them.

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Data Collection

The research I will be working with is purely theoretical and it does not require any data to be collected or created. The closest type of data I will use will be fabricated examples required to illustrate or to confirm the correctness of the mathematical research I will be doing.

I have no intention to collect data but I may fabricate a worked example for the research. This will be done by myself and the lead supervisor.

Documentation and Metadata

Any fabricated examples of note will either be given in publication or will be disregarded entirely.

Ethics and Legal Compliance

Not applicable

In terms of data this is not applicable. In terms of actual research I will ensure to properly cite any work that I use in my own research where necessary.

Storage and Backup

Not applicable

Not applicable

Selection and Preservation

Not applicable

Not applicable

Data Sharing

The examples will mainly be of use for myself but I will freely share them upon request.

Not applicable

Responsibilities and Resources

Not applicable

Not applicable