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# Plan Overview

*A Data Management Plan created using DMPonline*

**Title:** Max-plus switching systems and long max-plus matrix products

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**Template:** EPSRC Data Management Plan

## **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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**Copyright information:**

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

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## Data Collection

### What data will you collect or create?

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.

### How will the data be collected or created?

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

### What documentation and metadata will accompany the data?

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

## Ethics and Legal Compliance

### How will you manage any ethical issues?

Not applicable

### How will you manage copyright and Intellectual Property Rights (IPR) issues?

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**

**How will the data be stored and backed up during the research?**

Not applicable

**How will you manage access and security?**

Not applicable

## **Selection and Preservation**

**Which data are of long-term value and should be retained, shared, and/or preserved?**

Not applicable

**What is the long-term preservation plan for the dataset?**

Not applicable

## **Data Sharing**

**How will you share the data?**

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

**Are any restrictions on data sharing required?**

Not applicable

## **Responsibilities and Resources**

**Who will be responsible for data management?**

Not applicable

**What resources will you require to deliver your plan?**

Not applicable