



Eidgenössische Technische Hochschule Zürich  
Swiss Federal Institute of Technology Zurich

Lecture with Computer Exercises:  
Modelling and Simulating Social Systems with MATLAB

Project Report

**Trail formation with *Physarum polycephalum*  
of the Swiss rail network**

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## **Agreement for free-download**

We hereby agree to make our source code for this project freely available for download from the web pages of the SOMS chair. Furthermore, we assure that all source code is written by ourselves and is not violating any copyright restrictions.

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## **1 Abstract**

Generating a biologically inspired model of the Swiss railroad network depending on population growth. By using a biological (based on *Physarum polycephalum*) model, we want to simulate future scenarios of the Swiss railroad network. Probably a problem in future would be, that in fact of the population growth more people will use the public transport system. So we think it is necessary to simulate the main transport lines, to see where the system should be improved.

## **2 Individual contributions**

## **3 Introduction and Motivations**

## **4 Description of the Model**

The mathematical model is based on [1]. The urban areas (food sources) are the independent variables. By using theorems from hydro dynamics there exists three types of dependent variables for each node: conductivity, length and pressure.

As mentioned in [1], the flux prefers junctions with high efficiency (e.g. short connections). Because the flux in the system is constant, the junctions with high efficiency grow (getting thicker and more flux goes through), while the junctions with low efficiency shrink and disappear.

## **5 Implementation**

## **6 Simulation Results and Discussion**

## **7 Summary and Outlook**

## **8 References**

### **References**

- [1] Atsushi Tero, Ryo Kobayashi, and Toshiyuki Nakagaki. Physarum solver: A biologically inspired method of road-network navigation. *Physica A Statistica Mechanica and its Applications*, 2006.