

---

# Morse decomposition of regulatory networks via its determining nodes

Hiroshi Kokubu<sup>\*1</sup>, Bernold Fiedler<sup>2</sup>, Atsushi Mochizuki<sup>3</sup>, Gen Kurosawa<sup>3</sup>, and Hiroe Oka<sup>4</sup>

<sup>1</sup>Kyoto University – Japan

<sup>2</sup>Free University of Berlin – Germany

<sup>3</sup>RIKEN – Japan

<sup>4</sup>Ryukoku University – Japan

## Abstract

The regulatory network is a coupled ODE system associated with a network representing regulation relations among variables. This is a mathematical formulation of a biological regulatory network, given by Fiedler et al. (JDDE 2013).

One of the main theorems of their paper is that the global attractor of a regulatory network can be reconstructed if one monitors all the information of solutions on the negative real line only at a good subset of nodes called the feedback vertex set (abbrev. FVS). This means that one can understand the nontrivial global dynamics of the regulatory network only from its FVS variables. This is, however, not very useful for applications, as one needs to monitor infinitely long time.

In this talk, we shall show that, if we restrict attention to only a coarse information of global dynamics, namely its Morse decomposition, it is sufficient to monitor only on a finite time interval, or even at finitely many sample time points, at a FVS. We shall also show a result of numerical computation for Mirsky's circadian rhythm network as a test example.

This is a joint work with Bernold Fiedler, Free University of Berlin, Germany; Gen Kurosawa, RIKEN, Japan; Atsushi Mochizuki, RIKEN, Japan; Hiroe Oka, Ryukoku University, Japan.

---

\*Speaker