Control and Adaptation of Spatio-temporal Patterns

Hans H. Diebner[a], Axel A. Hoff[b], Adolf Mathias[a], Horst Prehn[c], Marco Rohrbach[a,c], and Sven Sahle[a]

[a] Institute for Basic Research, Center for Art and Media, Lorenzstr. 19, D-76135 Karlsruhe
[b] Steinbeis-Transferzentrum for Innovative Systems and Services, Am Seemooser Horn 20, D-88045 Friedrichshafen
[c] Institute of Biomedical Engineering, University of Applied Sciences, Wiesenstr. 14, D-35390 Gießen

Reprint requests to Dr. H. H. D.; E-mail: hans@diebner.de

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We apply a recently introduced cognitive system for dynamics recognition to a two-dimensional array of coupled oscillators. The cognitive system allows for both the control and the adaptation of spatio-temporal patterns of that array of oscillators. One array that shows Turing-patterns in a self-organizational manner is viewed as an externally presented dynamics (stimulus) which is mapped onto a mirror dynamics, whereby the latter is capable to simulate (simulus). Two of the parameters of the stimulus are thereby regarded to be unknown and have to be estimated by the cognitive system. The cognitive system itself consists of dynamical modules that are stimulated by the external dynamics in the sense of Pyragas' external force control mechanism and thereby yield measures of how good they match the stimulus. These measures are used as weights to construct the simulus. The adaptation process is performed "on the fly", i. e., without the storage of data. The proposed cognitive system, therefore, is a prominent candidate for the construction of a control device for a permanent real time observation of an external dynamical system in order to interfere instantaneously when necessary.

Key words: Adaptive Systems; Cognitive Systems; Pattern Formation; Brain Dynamics; Force Control.