Informatik-Kolloquium

Fachgruppe Informatik

Lehrstuhl für Informatik 12

RHEINISCH-WESTFÄLISCHE TECHNISCHE HOCHSCHULE AACHEN

EINLADUNG

Zeit: Donnerstag, 10. Juli 2008, 16.30 Uhr

Ort: Hörsaal AH I, Ahornstr. 55

Referent: PD Dr. Peter Dittrich
Nachwuchsgruppe Biosystemanalyse
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Titel: The Chemical Metaphor as a Paradigm for Modelling Biological, Social, and Organic Computing Systems

Abstract:

All known life forms process information on a bio-molecular level. Examples are: signal processing in bacteria (e.g., chemotaxis), gene expression and morphogenesis, defence coordination and adaptation in the immune system, or broadcasting information by the endocrine system. Moreover, various other processes like population dynamics and communication in social systems can be described by chemical-like models. These "chemical-like" systems are known to be robust, self-organizing, adaptive, decentralized, asynchronous, fault-tolerant, and evolvable. Because their behaviour emerges out of an orchestrated interplay of many decentralized relatively simple components (called molecules), understanding, controlling, and programming chemical-like systems appears to be difficult. In this talk I will show how the chemical metaphor can serve as a paradigm for modelling and programming biological, social, and (organic) computing systems. Furthermore, I will outline a novel theory to deal with complex chemical-like systems.

The so called chemical organization theory consists of two parts. The first part introduces the concept of a chemical organization as a closed and self-maintaining set of components. This concept allows to map a complex (reaction) network to its set of organizations. The theory provides a new view on the system's ``organizational structure'', which is fundamentally different from a pathway-oriented or network view. The second part of the approach connects dynamics with the set of organizations, providing a link to classical dynamical systems theory, e.g., by mapping a movement of the system in state space to a movement in the set of organizations. It is shown that every dynamically stable state must be an instance of an organization.

The presented results are obtained from joint work with:

Florian Centler (UFZ Leipzig), Christoph Kaleta (FSU Jena), Naoki Matsumaru (FSU Jena), and Pietro Speroni di Fenizio (DCU Dublin)