

TUTORIAL

"Artificial Chemistry - From Biological Modeling
to Chemo-inspired Computation"

by

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AIMS AND SCOPE:

The theme of this tutorial, Artificial Chemistry (AChem), is a research approach that tries to construct a bridge between bio-molecular systems and engineering systems. In a typical AChem study, we construct a model of a biological system at a molecular level, but unlike models in MD (molecular dynamics) or systems biology, we minimize the computational cost by dramatically simplifying the model, and trying to make self-organizing phenomena or functional emergence happen in a computer. Self-organization is one of the most distinctive features of bio-molecular systems, and with this AChem's approach, we can take one of the most promising approaches towards the design of computational systems with emergent characteristics.

This tutorial falls into two parts. The first half is primarily focused on the chemical reaction velocity theory. After prerequisite conditions for an AChem design are presented, the collision frequency between molecules with various sizes is evaluated. Then, the merits and demerits of several AChem models are discussed in light of this theory. In the latter half of the lecture, we take a representative AChem system named NAC (Network-based Artificial Chemistry) as an example, and discuss how the bio-molecular system can be emulated in a computational medium and how the model is used for some computational purposes.

TENTATIVE CONTENTS

1. Solution Space and Biological Evolution
2. Chemical Reaction Velocity Theory
3. Topological Analysis and Spatial Models
4. Network Artificial Chemistry
5. Revised NAC with Molecular Agents
6. Algorithmically Transitive Network

EXPECTED TIME LENGTH

Three hours

EXPECTED PARTICIPANTS:

20-25 people such as:

- * ALife researchers interested in chemical reaction approaches,
- * AChem researchers trying to find more substantial theoretical background for their models,
- * young students interested in self-organized computation, etc.