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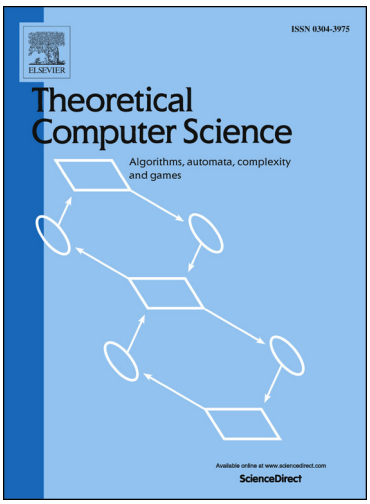

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Evolving Reaction Systems

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Abstract

Reaction systems were introduced as a formal model of interactions between biochemical reactions. These interactions, which are based on two mechanisms: facilitation and inhibition, determine the functioning of the living cell. Processes taking place in a reaction system $\mathcal{A}$ are driven by the fixed set A of available reactions provided by $\mathcal{A}$. In this paper we generalize this setup: as a process progresses from a state W to its successor W', the set of available reactions may change from A in W to A' in W'. This new framework of *evolving reaction systems* is introduced and studied in this paper. Also, the notion of enabling equivalence between sets of reactions and the notion of a transformation of a set of reactions are introduced and thoroughly studied.

Keywords: functioning of the living cell, reaction, reaction system, interactive process, equivalence, evolving set of reactions, evolution, punctuated equilibrium

1. Introduction

Reaction systems were introduced (see [11]) as a formal model of the functioning of the living cell. The underlying idea is that this functioning is determined by the interaction of biochemical reactions in the living cell, where these interactions are driven by two mechanism, facilitation and inhibition — the reactions (through their products) may facilitate or inhibit each other. This model takes into account the basic bioenergetics (flow of energy) of the living cell and the basic fact that the living cell is an open

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