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REVERTING AND COMBINING SOLITON BURSTS

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ABSTRACT

In this paper, we answer in the negative a question left open by Bordihn and Jürgensen, asking if in the Multi-Wave Soliton Automaton bursts of solitons are involutory, just as single solitons are involutory in the mono-wave case. We give instead a method which constructs for a given burst b a burst b' of the same length to revert the action of b. Furthermore, we give a method to combine multiple bursts to one burst simulating the same action of the original bursts.

Keywords: molecular computer, unconventional modes of computation, bond switching, soliton automaton, soliton wave, multiple soliton waves, finite automaton

1. Introduction

A Soliton Automaton is a semi-automaton which models the behaviour of a solitary wave, or soliton, traveling through a molecule and changing the molecular bonds on its way. A model for the mono-wave case, where only one soliton travels through the molecule at any given time, was defined by Dassow und Jürgensen in the 1980s ([3]). Later Bordihn, Jürgensen and Ritter [2], and Bordihn and Jürgensen [1] extended the original model to the multi-wave case, where several solitons, called a burst, travel through a molecule simultaneously.

We consider the model by Bordihn and Jürgensen: the molecule is represented by a weighted graph G, called soliton graph, and the solitons by pebbles travelling along the edges of G from an entry node to an exit node. While moving through G the pebbles change the weights of the edges they pass, hence they transform G into another soliton graph G'. For a set of bursts B and a soliton graph G, the Soliton Automaton $\mathcal{A}_B(G)$ has an initial state representing G. The other states represent soliton graphs obtainable from G by (iteratively) sending bursts from B through G. For any two states G', G'' there is a transition from G' to G'' if and only if there is a burst in B transforming G' into G''.

While working on this special issue of JALC, a solution to an open problem raised by Bordihn and Jürgensen in [1], see page 125 in the same issue, was found and is published with this paper here.