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Predecessors and Garden-of-Eden Configurations in Parallel Dynamical Systems on Maxterm and Minterm Boolean Functions

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Abstract

In this work, we solve the classical predecessor problems for parallel dynamical systems on maxterm and minterm Boolean functions. Actually, we solve analytically the *predecessor existence problem* by giving a characterization to have a predecessor for any given configuration. As a consequence, we also get a characterization of the Garden-of-Eden configurations of these systems. Moreover, the structure of the predecessors found out allows us to give a solution to the *unique predecessor problem*, the *coexistence of predecessors problem* and the *number of predecessors problem*.

Key words: Parallel dynamical systems, Boolean functions, Predecessors, Garden-of-Eden

MSC2010: 37E15, 68R10, 94C10, 37B99, 37N99

1 Introduction

From the studies by Wolfram on cellular automata (CA) in the eighties [39–42] and by Kauffman on Boolean networks (BN) in the seventies [29–31], network dynamical models have been considered as an efficient mathematical tool to model not only computational processes, but also several phenomena of other

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