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FIXPOINT SEMANTICS OF SYNCHRONIZED SYSTEMS AND CORRECTNESS OF THEIR BASIC TRANSFORMATIONS

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ABSTRACT

In recent years many systolic systems have been designed, some of them even manufactured as special purpose processors. Moreover, several design and transformation methodologies and software tools for the development of systolic systems have been worked out. However, the definitions and analysis of very basic concepts and results concerning systolic systems and their transformations seem to be still missing the rigour, abstraction and analysis required by the current design and correctness theory standards and also by applications. The aim of this paper is to remedy this situation by presenting a natural fixpoint semantics of synchronous systems (including semi-systolic and systolic) and by making precise and analysing in which way the basic transformations of these systems (retiming and slowdown) preserve their semantics.

Keywords: fixpoint semantics, systolic systems, semi-systolic systems, retiming transformation, slowdown transformation.

1. Introduction

The concept of systolic systems introduced in [11] has turned out to be interesting, stimulating and important — actually one of the most attractive current concepts in massive parallel computing. Originally, the idea of systolic systems has been seen as a natural generalization of pipelining and was aimed at the design of special-purpose and high-performance systems. Subsequently, the idea has turned out to be of broader importance and nowadays it can be seen as a quite general and powerful way to develop simple and highly regular parallel systems with small periods of computation, or, in

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