

Abstract

Brookes, S. and S. Geva, Towards a theory of parallel algorithms on concrete data structures, *Theoretical Computer Science* 101 (1992) 177-221.

Building on Kahn and Plotkin's theory of concrete data structures and sequential functions, Berry and Curien defined an intensional model of sequential algorithms between concrete data structures. In this paper we report on an attempt to develop a similar intensional model of concurrent computation. We present a notion of parallel algorithm between concrete data structures, together with suitable application and currying operations. We define an *intensional strictness* ordering on parallel algorithms, with respect to which application is well behaved (at first-order types). We define the *input-output function* computed by a parallel algorithm, and we show that every parallel algorithm computes a continuous function. Thus, a parallel algorithm may be viewed as a continuous function together with a parallel computation strategy. In contrast, a Berry-Curien sequential algorithm may be viewed as a sequential function together with a sequential computation strategy. The intensional strictness ordering on parallel algorithms corresponds to the pointwise ordering on the functions they compute, in the same sense that the set-inclusion ordering used by Berry and Curien on sequential algorithms corresponds to the stable ordering on the functions they compute.

We believe that the ideas and results presented here constitute a first step towards a fuller understanding of the intensional semantics of parallelism, even though the model presented here is not yet general enough to provide a satisfactory account of higher-order algorithms, and lacks a notion of composition for algorithms. We present some ideas for overcoming these deficiencies and some directions for further research.