

Index-Association Based Dependence Analysis and Its Application in Automatic Parallelization

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Abstract

In this paper, we present a technique to perform dependence analysis on more complex array subscripts than the linear form of the enclosing loop indices. For such complex array subscripts, we decouple the original iteration space and the dependence test iteration space and link them through *index-association* functions. The dependence analysis is performed in the dependence test iteration space to determine whether the dependence exists in the original iteration space. The dependence distance in the original iteration space is determined by the distance in the dependence test iteration space and the property of index-association functions. For certain non-linear expressions, we show how to equivalently transform them to a set of linear expressions. The latter can be used in traditional dependence analysis techniques targeting subscripts which are linear form of enclosing loop indices. We also show how our advanced dependence analysis technique can help parallelize some otherwise hard-to-parallelize loops.