

Partial Order Reduction Without the Proviso

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Abstract

In this paper, we present a new partial order reduction algorithm that can help reduce both space and time requirements of on-the-fly explicit enumeration based verifiers. The partial order reduction algorithms described in [God95, HP94, Pel94, Pel96] were observed to yield very little savings in many practical examples. The reason was traced to the *proviso* in these algorithms that often caused their search to generate many unnecessary states. Our algorithm, called the two-phase algorithm, avoids the proviso, and follows an execution strategy consisting of alternating phases of *partial order reduction of deterministic states* and *depth-first search*. In this paper, we describe the two-phase algorithm, prove its correctness, describe a new verification tool employing it, and provide a number of significant examples, including directory based protocols of a multiprocessor, that demonstrate the superior performance of the two-phase algorithm.