Algorithm Based Fault Tolerance Versus Result-Checking for Matrix Computations

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Abstract[1]

Algorithm Based Fault Tolerance (ABFT) is the collective name of a set of techniques used to determine the correctness of some mathematical calculations. A less well known alternative is called Result Checking (RC) where, contrary to ABFT, results are checked without knowledge of the particular algorithm used to calculate them.

In this paper a comparison is made between the two using some practical implementations of matrix computations. The criteria are performance and memory overhead, ease of use and error coverage. For the latter extensive error injection experiments were made. To the best of our knowledge, this is the first time that RC is validated by fault injection.

We conclude that Result Checking has the important advantage of being independent of the underlying algorithm. It also has generally less performance overhead than ABFT, the two techniques being essentially equivalent in terms of error coverage.

Keywords: Result-checking, ABFT, Fault injection, Error Detection, Matrix operations.