High-Order Dependency Free Range Bounding for Validated Global Optimization

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Taylor Model representations of functions allow the approximation of functions by floating point polynomials with an interval error that scales as a high order of the domain of approximation. Furthermore, the remainder is calculated in each step from the current intermediate polynomial representations, which leads to a far-reaching suppression of dependency even in the remainder term. One of the applications of Taylor models is the exclusion of regions in a global optimization framework. We develop a tool for a cutoff test near local minimizers that not only provides much reduced dependency, but also allows the rejection of boxes with higher than second order.

The behavior of the methods in various applications to global optimization are given, beginning with various common toy problems of the community, and also including a very challenging normal form stability estimate of the new Fermilab Tevatron particle accelerator.