Static bounds for straight-line programs

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How to automatically determine reliable error bounds for a numerical computation? One traditional approach is to systematically replace floating point approximations by intervals or balls that are guaranteed to contain the exact numbers one is interested in. However, operations on intervals or balls are more expensive than operations on floating point numbers, so this approach involves a non-trivial overhead.

We will present several approaches to remove this overhead, under the assumption that the function f that we wish to evaluate is given as a straight-line program (SLP). We will first study the case when the arguments of our function lie in fixed balls. For polynomial SLPs, we next consider the "global" case where this restriction on the arguments is removed. We will also investigate the computation of bounds for first and higher order derivatives of f.

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