Some Recent Advances in Validated Methods for IVPs for ODEs

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Validated methods for initial value problems (IVPs) for ordinary differential equations (ODEs) produce bounds that are guaranteed to contain the true solution of a problem. These methods use interval arithmetic to enclose rounding errors, truncation errors, and possibly even uncertainties in the model, assuming these can be quantified.

We summarize some recent advances in the area of validated ODE solving. In particular, we discuss (1) an interval Hermite-Obreschkoff scheme for computing tight enclosures on the solution, (2) instability in interval methods for IVPs for ODEs due to the associated formula for the truncation error, which appears to make it difficult to derive effective validated methods for stiff problems, and (3) a new perspective on the wrapping effect, where we view the problem of reducing the wrapping effect as one of finding a more stable scheme for advancing the solution.