Probabilistic Error Analysis of Limited-Precision Stochastic Rounding

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Abstract

Classical probabilistic rounding error analysis is particularly well suited to stochastic rounding (SR), and it yields strong results when dealing with floating-point algorithms that rely heavily on summation. For many numerical linear algebra algorithms, one can prove probabilistic error bounds that grow as ${O}(\sqrt{n}u)$, *where$n$istheproblemsizeand$u$istheunitroundoff.Theseprobabilisticboundsareasymptoticallytight*
caseones, whichgrowas${O}(nu)$.Forcertainclassesofalgorithms, SRhasbeenshowntobeunbiased.However, alltheseres
precisionSR.Bytakingintoaccountthenumber$r$ofrandombitsused, thisnewroundingmodematcheshardwareimplemen
precisionSRconvergestotheideal, unbiasedSRoperator.Wedevelopanovelmodelforprobabilisticerroranalysisofalgorith

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