Numerical Validation with the Discrete Stochastic Arithmetic on New Architectures

Jean-Luc Lamotte

1 Laboratoire d’Informatique de Paris 6, UPMC, CRNS UMR7606.
Jean-Luc.Lamotte@lip6.fr

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Now Scientists are facing up to a new age. Power of computer enables us to perform experiences in silicio. Modelisations are enough accurate to obtain results closed to reality, although they sometimes fail. Several reasons can be given: the modelisation is not close enough to reality, the model is unstable, etc. One reason is often forgotten: errors coming from computers. Indeed, numerical computations are based on floating point number representation which is only an approximation of real numbers. Each operation generates a very small error that can propagate and cause the computed result to become completely different than the expected one. Several methods are well known to study the round-off errors propagation.

The talk will focus on the DSA (discrete stochastic arithmetic) and its implementation: the CADNA software. The DSA allows us to study the round-off error propagation in all codes written in Fortran, C or C++ with few code modifications. This method is powerful but a bottleneck is the increase of the over-cost in computation time. Explanations and a solution will be given. In a second part, an overview of the CADNA implementation on multicore, distributed systems and GPU will be developed.

References

