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(Editors)

Numerical Software with Result Verification

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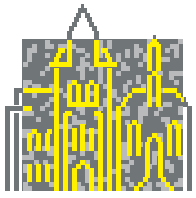

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Summary

Numerical computations are not reliable in the sense that rounding errors affect more or less every result of such a computation. Recently, several techniques have been developed to computationally circumvent these problems. The result of a computation then has the same rigour as a mathematical proof; it is therefore reliable and verified. The idea of the seminar was to bring together those who develop software for verified numerical computation and those who need such computations in their applications.

More than fifty scientists took part in this seminar. Each day started with a highlighted lecture on one of the main topics of the seminar. In order to stimulate interactions and to trigger discussions, participants were assigned to groups sharing a common subject: comprehensive software systems, libraries, enhanced software systems, object orientation, standardization, optimization, algorithms for verified numerical computation, novel approaches to validation, engineering and financial applications, applications in process simulation and control, applications in geometry and geodesics, applications in physics and chemistry.

During daytime, these groups presented their latest results in common sessions; this work was complemented by software demonstrations which took place in the evening.

For detailed information on all talks we refer to the abstracts in the proceedings as well as to the external home page of this conference which contains the slides of most of the lectures. (Links above) At this point we just mention the major lines of discussion and development which became evident through this seminar.

Validated numerical computation is now supported by a variety of numerical software. The latest developments show that fast validated computation can be achieved, that the high precision evaluation of standard functions is still an exciting area of development, that the integration with algebraic and symbolic computation becomes increasingly important and is supported more and more, and that techniques from compiler technology get used more and more in this area.

From the algorithmic point of view, the most impressive progress is being made in methods for global optimization, boosted by a European project. One of the strong points of the seminar was probably also the fact that many scientists from various application fields participated very actively. It became clear how validated numerical computation today enters such different areas like control theory, process simulation, mechanical reliability, robotics, chemistry, physics, geodesy and computational geometry.

Finally, it was interesting and stimulating to compare the different approaches to validation relying on interval arithmetic, stochastic arithmetic, static code analysis or artificial intelligence techniques like theorem proving.

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