# Preface

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Over the years, there has been increasing interest in solving mathematical problems with the aid of digital computers. Recently, this has included not only integer or 0/1 problems such as proving primality or identifying certain subgraphs (as in the proof of the Four Color Theorem), but also certain numerical problems (for example in the celebrated proof of the Kepler conjecture).

In general, the solution of these problems is too complicated to be represented in finite terms or this is even impossible. But frequently, one is only interested in existence of a solution within a certain domain and/or in error bounds for the solution. By the nature of the problems, numerical approximations are insufficient. Thus the goal of self-validating methods is: to deliver correct results on digital computers - correct in a mathematical sense, covering all errors like representation, discretization, rounding errors and others.

More precisely, the goals of self-validating methods are:

(i) to deliver rigorous results,
(ii) to compute these in a time not too far from that of a pure numerical algorithm,
(iii) to include the proof of existence (and possibly uniqueness) of a solution.

Self-validating methods have a strong connection to linear algebra since problems are frequently transformed into linearized problems with uncertain data. Then the linearization and discretization errors are estimated, possibly together with an infinite dimensional part of the problem.

The purpose of this special issue is to introduce some basics and new developments in self-validating (SV) methods to the LAA audience. Since the design of theorems on SV-methods intimately interplays with a computer implementation, we felt that some introduction to the principles of SV-methods would be helpful (see the next article).

Otherwise, we have a number of articles covering a variety of different SV-areas. The presented methods combine different fields like analytical methods, complexity theory, optimization or numerical methods with linear algebra. We hope that this special issue will draw attention of the readers to this new and promising research area.

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