Computer Science of Future Numerics: Software Engineering for Continuous Data Processing

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Since introduction of the IEEE 754 floating point standard in 1985, numerical methods have become ubiquitous—and increasingly sophisticated. With growing code complexity of numerical libraries grows the need for rigorous Software Engineering methodology: as provided by Computer Science and state of the art regarding digital processing of discrete data, but lacking in the continuous realm [1,2]. We apply, adapt, and extend the classical concepts — specification, algorithmics, analysis, complexity, verification — from discrete bit strings, integers, graphs etc. to real numbers, converging sequences, smooth/integrable functions, bounded operators, and compact subsets: A new paradigm [3] formalizes mathematical structures as continuous *abstract data types* with rigorous computable semantics [4]. Following the last decades' seminal interplay between Discrete Mathematics and Computer Science, Future Numerics revolves around Computer Science bridging between Pure and Applied continuous Mathematics.

References

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