Computing Stories

Optimization theory has existed before computers were invented, but the expansion of optimization and its wide range of applications was only possible due to the enormous growth and accessibility of modern computing machinery.

To address the importance of computing theory and practice for optimization I have asked four authors to cover some of these aspects. One article is on the history of NP-completeness where, for instance, some new insights into the prehistory of this important concept can be found. Another article is on the history of optimization modeling systems which are tools helping users to employ optimization algorithms efficiently. This is an area usually neglected by academic researchers but of high relevance for practitioners. A third article deals with the history of the reverse mode of differentiation, which is a methodology supporting, in particular, continuous optimization techniques by improving the information flow, memory management, sensitivity analysis, error estimation, conditioning, etc. Finally, the history of "Moore's Law" is reviewed that describes/postulates the exponential growth of computing power. How long will it stay alive?

The history of computing hardware is long and surveyed in many books and articles. One driving force of the computing machine development has always been the aim to reduce the effort necessary to carry out long calculations. Leibniz, for instance, stated: "It is unworthy of excellent men to lose hours like slaves in the labor of calculation which could safely be relegated to anyone else if machines were used." Leibniz himself made significant contributions to the design of mechanical computing devices.

Today, it is generally accepted that Konrad Zuse (1910–1995) built the first program-controlled computing machine in the world. Zuse studied civil engineering and earned his Diploma in 1935 at Technische Hochschule Berlin-Charlottenburg (today TU Berlin). He was annoyed by the repetitive statics calculations and decided to automate these procedures. His first computer, the Z1 finished in 1938, was mechanical. His Z3 was operational in 1941; it had the same logic design as the Z1, but used electrical components. It was a fully digital, floating-point, programmable machine. There are various Internet archives that document Zuse's achievements in detail. I recommend `http://www.zib.de/zuse/home.php`, maintained by Raul Rojas, and the Web page `http://www.zuse.org` of Horst Zuse, Konrad's son, that also provides numerous documents about his father and the computer technology he invented. Konrad

Figure 1: Zuse memorial plate
http://en.wikipedia.org/wiki/File:
Gedenktafel_Methfesselstr_10_(Kreuzb)_Konrad_Zuse.JPG

Zuse did most of his work in the prewar time in the living room of his parents, see Fig. 1, in intellectual isolation, assisted and financially supported by his family and a few friends only. Zuse has been honored, e.g., by naming the Konrad-Zuse-Zentrum für Informationstechnik Berlin after him.

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