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Optical SuperComputing: Preface to special issue

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The frequency and size inherent limitations of current processing technology leads the processor industry to introduce multi-core distributed/parallel devices in order to keep the Moore law processing capabilities growing. However, this is a dramatic change, as programs have to take into account these new-in-practice aspects. Moreover, the communication amongst cores should be fast and energy efficient, which in turn promotes the use of lasers on chips, as light is fast (fastest possible) and implies no crosstalks.

Once information is transferred by optical signals, the optics to electronics and electronics to optics translation is still an overhead to pay. Thus, processing of information by optics may be the very next breakthrough in processor technology, where energy saving, and small size (by using three dimensional devices) will allow the needed, next breakthrough.

The research in optical computing is focused on directions where optical devices can beat electronic counterparts by large amounts. One good example is Rainbow sort (Schultes 2005) which has an impressive O(1) complexity.

Still, there are not so many theoretical (and more important) practical examples of such cases. Much more research is needed in order to develop more ideas and bring the existing ones to market.

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The International Workshop on Optical SuperComputing (OSC) is a forum for research presentations on all facets of optical computing for solving hard computational tasks.

The fourth edition of OSC took place in 2012 in Bertinoro (Website for Optical SuperComputing 2012). Twelve regular and invited papers have been presented during the workshop. The proceeding was published by Springer LNCS (Dolev and Oltean 2013).

A post-conference special issue has been accepted in the Natural Computing journal.

The following four papers have been selected for inclusion in this issue:

- *Holographic parallel processor for calculating Kronecker product* by *Shlomi Dolev, Nova Fandina, Joseph Rosen*, describes an optical device capable of computing the Kronecker product of two matrices in one step.
- *Computation with optical sensitive sheets* by *Sama Goliaei, Saeed Jalili*, introduces an optical model called filter machine. An example on how to solve the *k-clique* problem is provided.
- *To what extent is zero energy computing feasible?* by *Joseph Shamir*, discusses basic principles of zero energy computers and indicates some misleading ideas about reversible computing.
- *Compressive scanning of an object signature* by *Jonathan I. Tamir, Dan E. Tamir, Wilhelmus J. Geerts, Shlomi Dolev*, describes a framework which could replace parts of digital processing with optical processing.

These papers present various aspects of the current research in optical computing. We hope that the future will bring more light in this fascinating field.

References

Dolev S, Oltean M (eds) (2013) Optical super computing. 4th international workshop, OSC 2012, in Memory of H. John Caulfield, Bertinoro, Lecture Notes in Computer Science 7715, Springer

Schultes D (2005) Rainbow sort: sorting at the speed of light. Nat Comput 5(1):67–82

Website for Optical SuperComputing (2012) http://www.cs.bgu.ac.il/~dolev/OSC12