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Mathematics of computing at CiE 2005

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The ten papers in this special issue arose from the conference *CiE 2005: New Computational Paradigms*, held at the University of Amsterdam in June, 2005. *CiE 2005* was the first of a new series of conferences associated with the interdisciplinary network *Computability in Europe* focused on computability in theoretical computer science and mathematical logic, and ranging over a broad spectrum of research areas from the application of novel approaches to computation, through computability-theoretic aspects of physical systems to set-theoretic analyses of infinitary computing models.

Computability theory is central to large areas of theoretical computer science and mathematical logic. Traditionally, the computational model of the Turing machine (or mathematically equivalent models) has been used to reason about computation or computability. For general computability inquiries (with unbounded resources), the choice of the model of computation hardly matters (this fact is encapsulated in the so-called 'Church–Turing thesis'); this can change as soon as questions of efficiency are investigated. In all areas of computability theory, alternative models of computation have been investigated, ranging from the most abstract (such as generalised recursion theory and infinite time Turing machines) to the very concrete (such as physical constructions of quantum computers, applications in neuroscience and learning theory, fine grained parallelism, swarm intelligence, neural nets, agents and games). *CiE 2005* was an interdisciplinary venue for researchers from computer science and mathematics to exchange ideas, approaches and techniques in their respective work, thereby generating a wider community for work on new computational paradigms that allows uniform approaches to diverse areas, the transformation of theoretical ideas into applicable projects and a general cross-fertilisation transcending disciplinary borders.

CiE 2005 has developed into a conference series (CiE-CS), and will be continued with meetings in Swansea (2006), Siena (2007), Athens (2008), Heidelberg (2009) and Lisbon (2010).

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In order to properly integrate both mathematicians and computer scientists into the *CiE* community, we needed to adapt to the two very different publication cultures. For computer scientists, the presentation at a conference with a publication in a pre-published proceedings volume counts as a publication, and a conference without a respectable preproceedings volume will not be attractive to them. On the other hand, mathematicians often present unfinished work at conferences in order to polish it for publication after the conference. If the *CiE* conferences are to be attractive to both communities, they need to follow both styles. *CiE 2005* had a regular preproceedings volume published in *LNCS*:

Cooper, S. B., Löwe, B. and Torenvliet, L. (*eds.*) (2005) New Computational Paradigms, First Conference on Computability in Europe, CiE 2005, Amsterdam, The Netherlands, June 2005. *Springer-Verlag Lecture Notes in Computer Science* **3526**.

As a follow-up to the conference, the organisers of *CiE 2005* have also prepared some post-conference publications, which are organised by topics. Three special issues of journals are being edited with journal versions of talks and presentations at *CiE 2005*, one on natural computing, one on the theory of computation and one on the mathematics of computing.

This special issue of the journal *Mathematical Structures in Computer Science* is the post-conference publication on the 'mathematics of computing'. Five of the articles in this special issue are full versions of papers accepted for publication in the *LNCS* preproceedings. The other five are largely new papers authored or co-authored by invited speakers from two of the *CiE 2005* Special Sessions: the *Special Session on Proofs and Computation*, which was organised by A. Beckmann (Vienna) and L. Crosilla (Florence); and the *Special Session on Relative Computability*, which was organised by B. Cooper (Leeds) and A. Sorbi (Siena).

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The conference was jointly sponsored by the *Koninklijke Nederlandse Academie van Wetenschappen* (KNAW), the *Nederlandse Organisatie voor Wetenschappelijk Onderzoek* (NWO), the *European Association for Theoretical Computer Science* (EATCS) and the *Association for Symbolic Logic* (ASL).

For the most current information about the conference series CiE-CS, refer to our webpage at `http://www.illc.uva.nl/CiE/`.

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