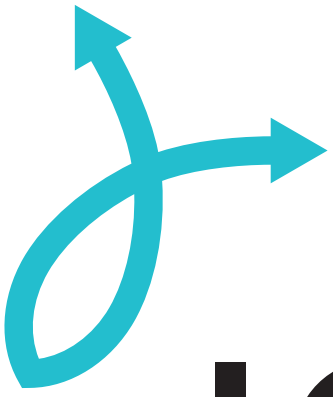
Annual Report 2012



ICE-TCS

Icelandic Centre of Excellence
in Theoretical Computer Science

Contents

1 Introduction

The Icelandic Centre of Excellence in Theoretical Computer Science (ICE-TCS) celebrated its eight birthday on 29 April 2013. This seventh annual report is meant to give the (Theoretical) Computer Science community in Iceland and elsewhere, our sponsors and funding agencies, and our scientific advisory board an overview of the activities of the centre in 2012. It will also allow us to evaluate our achievements vis-a-vis our original aims in setting up this centre, and to set ourselves goals for the future.

For the sake of completeness, we remind our readers that the aim of the centre is to establish in Iceland important areas of basic research in the mathematical foundations of Computer Science, notably Algorithmic Program Verification, Mathematical Logic in Computer Science, Models and Logics for Reactive Systems, Semantics of Computation and Systems Biology, alongside existing activities in Algorithmics, Bioinformatics, Applied and Discrete Mathematics and Machine Learning.

ICE-TCS aims at exploiting the available scientific strength in order to

- focus the research efforts, and establish synergies amongst the active researchers in Iceland,
- attract outstanding researchers in Theoretical Computer Science to Iceland for short- or long-term visits leading to collaborations with local researchers and to improvements in the Icelandic research environment,
- organize international conferences and workshops in Theoretical Computer Science in Iceland to put the country firmly on the map as a recognized conference location for high quality events in the field, and
- attract young, outstanding students from Iceland to this research area.

The research centre initially started as a collaboration between the Department of Computer Science, Faculty of Engineering, University of Iceland, and the School of Computer Science, Reykjavik University. Since 2011, the centre has been based solely at Reykjavik University and has some affiliated members from the University of Iceland. However, it is fair to say that all the activities of the centre take place at Reykjavik University.

Further information is available from the centre's web page at:

http://www.icetcs.ru.is.

2 Executive Summary and Highlights for the Reporting Period

The calendar year 2012 has been a very active one for ICE-TCS, both nationally and internationally.

During 2012, members of the centre have published papers in leading international conferences and journals. By way of example, we limit ourselves to mentioning that ICE-TCS researchers contributed three papers to ICALP 2012, two papers to the 2012 editions of FPSAC, MFPS and PODC, and one paper to SODA 2012. These publications have further reinforced the importance of the centre for research in computer science in Iceland. Indeed, it is worth noting that ICE-TCS contributes four out of the five Icelandic entries to the list of DBLP most prolific authors.

The year 2012 was the Alan Turing Year, a centenary celebration of the life and work of Alan Turing, who was, without doubt, one of the most influential scientists of the twentieth century. ICE-TCS took part in the celebration by organizing a series of talks on the highlights of Turing's work

as well as other events. The Turing Year events at Reykjavik University were organized in collaboration with the School of Computer Science at Reykjavik University, the Icelandic Mathematical Society, the Center for Analysis and Design of Intelligent Agents and the Icelandic Institute for Intelligent Machines.

In December 2012, ICE-TCS graduated its third PhD student, Kristján V. Jónsson. In the spring of 2013, Kristján also received a doctoral degree from KTH, Stockholm, as part of a double-degree agreement between the School of Computer Science at Reykjavik University and that institution.

In 2012, ICE-TCS researchers received recognition for their research work and service to the research community. Luca Aceto received the Reykjavik University Research Award for 2012. (This is the second time that the award has gone to an ICE-TCS researcher in three years.) Postdoctoral researcher Dario Della Monica was awarded the GULP prize for the best PhD dissertation in the area of Computational Logic for the years 2010–2011. (GULP is the Italian Association for Logic Programming.) Luca Aceto was elected as the new president of the European Association for Theoretical Computer Science (EATCS) at ICALP 2012.

Moreover, in July 2012, Mike Paterson (University of Warwick, UK) joined the scientific advisory board of ICE-TCS.

The following subsections survey briefly what the centre has achieved in the reporting period.

Events

During 2012, Magnús M. Halldórsson organized SIROCCO 2012, the 19th International Colloquium on Structural Information and Communication Complexity, at Reykjavik University and served as PC co-chair for the event. He was also the organizer of the Third Workshop on Realistic models for Algorithms in Wireless Networks (WRAWN), co-located with ICALP 2012. In addition, ICE-TCS held the eighth edition of the annual Theory Day, which, apart from three contributed talks, celebrated the award of the Gödel Prize 2012 to three papers in algorithmic game theory and mechanism design and of the EATCS Award 2012 to Moshe Vardi, who is a member of the scientific advisory board of ICE-TCS.

Below we list the main events in reverse chronological order. See

http://www.icetcs.ru.is/events.html

for more details.

- 13 December 2012: Kristján V. Jónsson defended his PhD thesis *The Security Properties of In-network Aggregation.* The thesis was supervised by ICE-TCS member Ýmir Vigfússon. The evaluation committee consisted of Mads F. Dam (KTH Sweden), Magnús Már Halldórsson (Reykjavik University) and Philippe Bonnet (IT Univ. of Copenhagen, Denmark). Kristján V. Jónsson is the third PhD student graduating under the supervision of an ICE-TCS member.

- 30 November 2012: Páll Melsted (University of Iceland) delivered an ICE-TCS seminar entitled *The greatest theorem you'll never use!* This seminar, which was organized jointly with the Icelandic Mathematical Society, celebrated the award of the 2012 Abel Prize to Endre Szemerdi.

- 9 November 2012: Vignir Örn Gumundsson (Reykjavik University) delivered the seminar number 200 in the ICE-TCS seminar series.

- 5 November 2012: Dario Della Monica was awarded the GULP prize for the best PhD dissertation in the area of Computational Logic for the years 2010-2011. GULP is the Italian Association for Logic Programming. Congratulations to Dario!

- 6 September 2012: Screening of the drama documentary film *Codebreaker* (Icelandic premiere).

- 17 August 2012: The ICE-TCS Theory Day for 2012.

- 9 July 2012: Luca Aceto was elected as the new president of the European Association for Theoretical Computer Science (EATCS), to serve for the next two years.

- 8 July 2012: Magnús Halldórsson organized the The Third Workshop on Realistic models for Algorithms in Wireless Networks (WRAWN), co-located with ICALP 2012.

- 30 June–2 July 2012: Magnús Halldórsson hosted the 19th International Colloquium on Structural Information and Communication Complexity (SIROCCO 2012) at Reykjavik University. Magnus was also PC co-chair for the event.

- May–June 2012: Luca Aceto delivered the doctoral courses *Modelling, Specification and Verification of Reactive Systems* and *All you ever wanted to know about writing or refereeing papers, and giving talks, but you never dared to ask* at IMT Lucca, Italy.

- 23–27 April 2012: Luca Aceto delivered an invited MSc course on *Bisimilarity and Logic* at Universidad Complutense de Madrid, Spain.

- 29 March 2012: Performance of the play *Alan M. Turing: The Man and the Scientist*.

- 23 March 2012: Luca Aceto received the Reykjavik University Research Award for 2012. This is the second time that the award has gone to an ICE-TCS researcher in three years.

The ICE-TCS Turing Centenary Events are listed below in chronological order.

- 12 January 2012: Talk by Luca Aceto on Alan Turing's work on computability and the universal computer. (Joint with the Icelandic Mathematical Society.).

- 17 February 2012: Talk by Ýmir Vigfússon on Alan Turing's codebreaking work. (Joint with the Icelandic Mathematical Society.)

- 15 March 2012: Talk by Bjarni V. Halldórsson on Alan Turing's work on mathematical biology. (Joint with the Icelandic Mathematical Society.)

- 29 March 2012: Talk by Magnús M. Halldórsson entitled *The million dollar question: P vs. NP, and the legacy of Turing.* (Joint with the Icelandic Mathematical Society.)

- 12 April 2012: Talk by Yngvi Björnsson and Kristinn R. Thórisson entitled *Alan Turing's Contributions to Artificial Intelligence: Can Machines Think?* Alan Turing was one of the pioneers of artificial intelligence and took an early interest in the question as to whether it is possible for machinery to show intelligent behaviour. In this talk, Yngvi Björnsson and Kristinn R. Thórisson summarized Alan Turing's contributions to the field of artificial intelligence, including the famous Turing Test designed for verifying computers' ability to exhibit intelligent behaviour.

- 6 September 2012: Screening of the drama documentary film *Codebreaker* (Icelandic premiere).

- 17 December 2012: The final event of the ICE-TCS Alan Turing Year. The general theme for the event was *The Future of Computing.* The

programme consisted of five-minute contributions by several members of the School of Computer Science at Reykjavik University followed up by a question-and-answer session with the audience.

The posters for the talks and further information, as well as the slides and audio of most of the talks are available in .avi format at

http://www.icetcs.ru.is/turingyear2012RU.html

As in previous years, 'regular' events, such as talks in our seminar series, have been advertised locally and on our ever-increasing mailing lists, which include well over 150 individuals at the time of writing. Events that are appealing to a general audience have also been advertised in the local newspapers, and on the mailing lists of Reykjavik University as a whole, of the mathematical society and of the computer science society. In all cases, ICE-TCS events have been a large fraction (if not the majority) of advertised events. In fact, it is fair to say that the ICE-TCS Research Seminar series continues to be the only regular seminar series in Computer Science in Iceland, and one of the very few seminar series in the country that have more than a handful of talks each year. During the reporting period, the ICE-TCS Research Seminar series hosted 28 seminars, not counting the talks delivered as part of the above-mentioned events.

Outreach

One of the goals of the centre is to foster an appreciation of discrete mathematics and theoretical computer science within a general scientifically-minded public and to attract students to these fields. As part of this effort, ICE-TCS member Bjarni V. Halldórsson has continued his involvement in the training of the Icelandic Maths Olympiad team. Henning Úlfarsson represented ICE-TCS at Vsindavaka, which is an annual, and very well attended, Icelandic Science Night. Moreover, ICE-TCS is organizing joint events with the Icelandic Mathematical Society and other research centres at Reykjavik University, including many of the ICE-TCS Turing Centenary Events.

Some educational initiatives during the reporting period were aimed at BSc. and MSc. students. Of particular note is the official start of the new Bachelor program in Discrete Mathematics and Computer Science at Reykjavik University. The prime movers behind this new study program are Anna Ingólfsdóttir and Henning Úlfarsson. The program started without

formal advertisement in Fall 2011, and has been successful in attracting about ten talented and motivated students. As an alternative way of attracting more theoretically-minded students to discrete mathematics and theoretical computer science, we have also designed an 'emphasis line' in theoretical computer science as part of the BSc. degree in computer science at Reykjavik University.

Moreover, ICE-TCS members continue to play a leading role in the design and running of novel courses such as *Problem Solving* for first-year students in Computer Science, *Effective Programming and Problem Solving* for BSc. students, *Combinatorial Game Theory* for BSc. students, *The Structure of Social and Information Networks* (intensive summer course for BSc. students) and *Logic in Computer Science* for third-year BSc. students and MSc. students.

ICE-TCS events have managed to attract a sizable attendance. Beyond members of the centre, nearly every meeting is attended by some researcher from fields with areas of contact with theoretical computer science. We also continue to host a small number of talks by researchers from sister fields like mathematics and physics, with the aim to explore possible synergies between their work and the research carried out within the centre. As mentioned above, ICE-TCS has strengthened its connections with the Icelandic Mathematical Society. In particular, two members of ICE-TCS are on the board of the Icelandic Mathematical Society.

ICE-TCS research continues to involve students and other young researchers. The number of students affiliated with the centre is still small, but will grow further in 2013. During the reporting period, members of ICE-TCS have supervised six MSc. students in computer science and seven PhD. students (six in computer science and one in bioinformatics). Marijke Bodlaender joined the centre as a doctoral student in August 2012 to work with Magnús M. Halldórsson on the newly-funded project *Design of Ad-Hoc Wireless Networks*.

Research Highlights

At the time of writing, according to our records that are available at `http://www.icetcs.ru.is/publications.pdf`, ICE-TCS members have a total of 360 publications since the establishment of the centre: two books, 20 edited volumes, six book chapters, 187 journal papers, 144 conference and workshop papers and seven abstracts in peer-reviewed ISI-indexed journals. By way of comparison, the overall number of publications was 297 at the time of writing our annual report for 2010 and 339 for 2011. Since the time

of writing the annual report for 2011, ICE-TCS researchers have published 12 journal papers and 15 conference and workshop papers.

The centre still has substantially more journal publications than conference publications. However, the difference between the two figures is decreasing. We expect that this trend will continue in the coming years, but we will strive to continue publishing in journals a substantial percentage of our scientific work.

Below, we limit ourselves to pointing out a few highlights of the research work carried out within the centre in the reporting period.

- The algorithms group had papers on wireless algorithmics and other topics in several top-level conferences, including CISS 2012, ICALP (two papers) and PODC 2012 (one paper and one brief announcement).

- The bioinformatics group had its first publication in ISMB, the top rated conference in bioinformatics.

- Research in combinatorics focused on the study of permutation patterns and of their connections to Schubert varieties, on the new notion of decorated patterns, and the use of algorithms for generating conjectures and proofs. The group had two papers accepted for FPSAC 2012, which is the most selective conference in the field, two journal papers, and a talk at the Joint Mathematics Meetings of the American Mathematical Society.

- The concurrency group within ICE-TCS continued its work on rule formats for guaranteeing the validity of algebraic properties and studied the expressive power of classes of algebraic recursion schemes for defining synchronization trees. Amongst others, the group published one conference paper in the proceedings of ECAI 2012 and ICALP 2012, two journal papers in MSCS and one in SCP and TCS.

- The formal methods for software engineering group continued its development of the specification language Rebeca and its associated tool support. Amongst others, the group published three journal papers in SCP.

3 Current Members and Their Research Areas

ICE-TCS has now eight permanent members (all at Reykjavik University) and four affiliated members (two at the University of Iceland, one at the

University of Strathclyde and one at Université de Lyon 1). The present members of the centre are: Luca Aceto (Scientific Co-director), Eyjólfur Ingi Ásgeirsson, Yngvi Björnsson, Bjarni V. Halldórsson, Magnús M. Halldórsson (Scientific Director), Anna Ingólfsdóttir (Scientific Co-director), Marjan Sirjani, Henning Úlfarsson and Ýmir Vigfússon.

In addition, at the time of writing, the centre hosts one postdoctoral researcher: Dario Della Monica (temporal logics). Two more postdoctoral researchers will be hired in 2013 to work on the project *Design of Ad-Hoc Wireless Networks*, with Magnús M. Halldórsson as principal investigator, which was awarded an excellence grant by the Icelandic Research Fund in December 2011.

Currently, the centre has five PhD. students (four in Computer Science and one in Bioinformatics). Four of those students are from outside Iceland.

At present, the members of ICE-TCS carry out research in the following main areas of Theoretical Computer Science and Discrete Mathematics: Algorithms and Complexity, Bioinformatics, Combinatorics, Computer-aided Verification, Concurrency Theory, Formal Methods in Software Engineering, Machine Learning, Search Methods in Artificial Intelligence and Structural Operational Semantics. With the recent addition of Ýmir Vigfússon, ICE-TCS has gained research presence also in the fields of distributed systems, cloud computing, mathematical modelling, data mining, computer security, randomized algorithms and epidemiology.

Algorithms group The majority of recent efforts of the algorithms group has been within a subgroup on wireless networking. That subgroup is rather large, by Icelandic standards, and has included Marjike Bodlaender, Magnús M. Halldórsson, Pradipta Mitra, Eyjólfur I. Ásgeirsson, Henning Úlfarsson and Ýmir Vigfússon. Additionally, Sverrir Ólafsson (from RU School of Science and Engineering and Business) has collaborated with the group. The main research effort has been on giving efficient and effective algorithms for link scheduling and capacity in generic wireless networks. More recently, studies have included connectivity and aggregation capacity, as well as connections with game theory and stability of networks. With the expansion of the efforts in 2012, the group has additionally explored spectrum auctions, testbed operation and higher-level distributed computing problems.

Other efforts on algorithms included streaming algorithms and online algorithms motivated by distributed computing.

Bioinformatics group The bioinformatics group continued its work on algorithms for analyzing DNA sequence reads, the analysis of DNA sequences. The group also ventured into developing clinical information systems and analysis of zebra fish behavioural data.

Combinatorics Research in combinatorics has focused on the study of permutation patterns and of their connections to Schubert varieties, on the new notion of marked mesh patterns, on inversion statistics on permutations and on word representability for classes of graphs.

Concurrency theory group The research efforts within the concurrency theory group have mainly focused on negative and positive results in the equational logic of process algebras, on the meta-theory of structural operational semantics, with emphasis on rule formats for guaranteeing the validity of certain algebraic properties of processes, and on modal characterizations of process semantics. In addition, the group has worked on the classification of the expressive power of fragments of the interval temporal logic of Allen's relations.

Software engineering group The software engineering group has focused on the further development of the theory and applications of the actor-based language Rebeca, and of its associated tool suite.

4 Funding

Despite the increasingly hard competition and the decrease in the available funding, ICE-TCS researchers continue to be fairly successful in obtaining grants from the Icelandic Fund for Research. In the latest round of applications for projects starting in January 2012, Magnús M. Halldórsson obtained a three-year excellence grant from the Icelandic Research Fund for the project *Design of Ad-Hoc Wireless Networks* of total amount of 56,530,000 ISK (about 342,600 euros) This was the only such grant (over all fields) awarded in response to the call issued in 2011. Moreover, in May 2012, Ali Jafari received a competitive PhD scholarship from the Icelandic Research Fund. The grant amounts to 8,400,000 ISK (about 53,248 euros) over a period of two years.

In addition, the following project grants were still ongoing during the reporting period:

- *General Intelligence Problem-Solving Agents* (PI: Yngvi Björnsson),

Stefan Schmid (Internet Network Architectures (INET), TU Berlin / Telekom Innovation Laboratories (T-Labs)). Period: 20–24 August 2012.
Leon Danon (Mathematics Institute, University of Warwick). Period: 30 January–2 February 2012.
Zoltan Esik (University of Szeged, Hungary). Period: 19–27 January 2012.
Joshua Sack. Period: 9–13 January 2012.

Table 1: ICE-TCS Guests in 2012

- *Meta-Theory of Algebraic Process Theories* (PI: Luca Aceto),
- *Processes and Modal Logics* (PI: Anna Ingólfsdóttir).

We remark that these grants, however, can only be used to support project specific activities, and *not* for activities related to the centre as such. Whatever success ICE-TCS might have had so far has therefore been achieved with minimal financial support for centre-building. We believe that the quantity and quality of the centre's activities, and its impact on research and education in computer science in Iceland, could be increased substantially if ICE-TCS had more funding.

5 Activities in 2012

5.1 Guests

During the reporting period, we received 4 guests from foreign institutions for short stays. These are listed in Table 1 in reverse chronological order. All the guests delivered seminars and/or contributed (mini-)courses organized by the centre.

5.2 Organization of Conferences, Symposia and Workshops

Members of the centre have served as organizers and PC members for the following events.

- Luca Aceto: Foundations of Software Science and Computation Structures (FOSSACS 2012), Tallinn, Estonia, March 2012. (PC member)
- Luca Aceto: ICE 2012, 5th Interaction and Concurrency Experience, June 16, 2012, Stockholm, Sweden. (PC member)
- Luca Aceto: EXPRESS/SOS 2012, joint workshop on Expressiveness in Concurrency and Structural Operational Semantics, Newcastle upon Tyne, United Kingdom, September 3, 2012. (PC member)

- Luca Aceto: 23rd International Conference on Concurrency Theory (CONCUR 2012), Newcastle upon Tyne, UK, 3rd–8th of September 2012. (PC member)
- Luca Aceto: NWPT'12, 24th Nordic Workshop on Programming Theory, 31 October–2 November 2012, Bergen, Norway. (PC member)
- Bjarni V. Halldórsson: RECOMB 2012, 16th Annual International Conference on Research in Computational Molecular Biology, 21–24 April 2012, Barcelona. (PC Member)
- Bjarni V. Halldórsson: ISMB 2012, 15–17 July 2012, Long Beach, CA. (PC Member)
- Magnús M. Halldórsson: Third Workshop on Realistic models for Algorithms in Wireless Networks (WRAWN), co-located with ICALP 2012, 8 July 2012. (Organizer)
- Magnús M. Halldórsson: 19th International Colloquium on Structural Information and Communication Complexity (SIROCCO 2012) at Reykjavik University. 30 June-2 July 2012. (Host and PC co-chair).
- Marjan Sirjani: Coordination 2012. (PC chair)
- Marjan Sirjani: ICFEM 2012. (PC member)
- Marjan Sirjani: AGERE'12. (PC member)
- Marjan Sirjani: FMICS 2012. (PC member)
- Marjan Sirjani: ICSSEA 2012. (PC member)
- Marjan Sirjani: FOCLASA 2012. (PC member)
- Ýmir Vigfússon: 12th IEEE International Conference on Peer-to-Peer Computing (P2P12), Tarragona, Spain. September 2012. (PC member)
- Ýmir Vigfússon: 17th Nordic Conference on Secure IT Systems (Nordsec), Karlskrona, Sweden. October 2012. (PC member)
- Ýmir Vigfússon: 6th ACM SIGOPS/SIGACT Workshop on Large-Scale Distributed Systems and Middleware (LADIS) workshop, Madeira, Portugal. July 2012. (PC member and General Co-chair)
- Ýmir Vigfússon: TERENA Networking Conference (TNC), Reykjavik, Iceland. May 2012. (PC member)

5.3 Service and Honours

Members of ICE-TCS participate in the life of the international research community in Theoretical Computer Science at large. For instance, they hold positions in the steering committee of conferences and professional organizations, and act as (guest) editors of volumes and international journals. A sample of service activities contributed by members of the centre can be found in Table 2.

5.4 ICE-TCS Seminar Series

One of the main aims of ICE-TCS is to foster a broad appreciation of the field of Theoretical Computer Science in Iceland, and to help improve the Icelandic research environment in Computer Science at large. To this end, during 2012, the centre has organized the following seminar series:

- Research Seminar Series, and
- Reading groups.

These two seminar series are supposed to cater for different types of audiences and of presentations. As its name suggests, the *Research Seminars Series* is used for technical presentations reporting on research that has reached a fairly complete stage of development. Overall, there have been 28 seminars in this series during the reporting period. (See `http://www.icetcs.ru.is/rsem.html` for details on these talks.) This is a large increase from the 17 seminars we had in 2011, but similar to the 26 seminars we had in 2010. However, in 2011 ICE-TCS organized a much greater number of conferences and workshops than in 2012. Overall, we think that the centre's contribution to the research environment in computer science and related fields has been substantial during the reporting period.

Reading groups are used by ICE-TCS to learn about topics that have the potential of creating synergies amongst the members of the centre, or as fora for the discussion of research in one of the core areas of the centre. An example of the former use of a reading group is provided by the weekly concurrency lunch meetings. The weekly meeting of the wireless networking subgroup has included a reading group on game theory and auctions. Moreover, Marjan Sirjani holds weekly lunches with students working on formal methods in software engineering on Fridays.

Membership and Steering of Learned Bodies

- Luca Aceto is a member of the EATCS council.
- Luca Aceto is the chairman of the Publication Committee of the EATCS.
- Luca Aceto is a member of the ICALP Liaison Committee of the EATCS.
- Luca Aceto is a member of the advisory board of *Electronic Proceedings in Theoretic Computer Science (EPTCS)*.
- Luca Aceto is a member of the Scientific Board of the Doctoral Program in Computer Science and Engineering at IMT Lucca (October 2011–July 2012).
- Bjarni V. Halldórsson is a committee member of the IFIP working group on computational biology.
- Bjarni V. Halldórsson is event organizer for the EURO working group on computational biology.
- Magnús M. Halldórsson is a member of the steering committee for the Scandinavian Workshop on Algorithm Theory series. He is chair of that committee since March 2007.
- Magnús M. Halldórsson is a member of the steering committee for the European Symposium on Algorithms.
- Anna Ingólfsdóttir is a member of the steering committee for the Workshop on Fixed Points in Computer Science (FICS).
- Anna Ingólfsdóttir is a member of the board of the Icelandic Mathematical Society.
- Marjan Sirjani is a member of the steering committee for DisCoTec (International Federated Conference on Distributed Computing Techniques).
- Henning Úlfarsson is the chairman of the Icelandic Mathematical Society.

Membership of Editorial Boards

- Information and Computation, Elsevier. (Luca Aceto guest editor of a special issue devoted to ICALP 2011)
- Journal of Logic and Algebraic Programming, Elsevier. (Luca Aceto editor and Anna Ingólfsdóttir guest editor)
- Acta Cybernetica (a scientific journal published by the Department of Informatics of the University of Szeged, Szeged, Hungary). (Luca Aceto editor)
- Electronic Proceedings in Theoretic Computer Science (EPTCS). (Luca Aceto editor)
- Frontiers in Statistical Genetics and Methodology. (Bjarni V. Halldórsson editor)
- Discrete Mathematics and Theoretical Computer Science. (Magnús M. Halldórsson managing editor)
- Soft Computing Journal (to be published by University of Kashan). (Marjan Sirjani Editor-in-Chief)

Table 2: Service and Honours by Members of ICE-TCS

5.5 Courses and Students

As far as impact on the Icelandic Computer Science community is concerned, one of the main aims of ICE-TCS has always been to attract students to Theoretical Computer Science. Teaching, in the broad sense, plays a very important role in achieving this aim, and the members of ICE-TCS engage in course development and in student supervision. Apart from our dissemination activities related to the seminar series and the reading groups, ICE-TCS researchers have delivered classic courses on *Algorithmics* and *Theory of Computation*, at various levels, as well as more specialized courses on *Bioinformatics*, *Logic in Computer Science*, *Modelling and Verification*, *Problem Solving* and on *Semantics of Programming Languages* at Reykjavik University.

Members of the centre have supervised the following PhD students, six of which are affiliated with ICE-TCS.

- Marijke Bodlaender (Reykjavik University), PhD student working on her thesis supervised by Magnús M. Halldórsson.
- Georgiana Caltais (Reykjavik University), PhD student working on her thesis supervised by Luca Aceto and Anna Ingólfsdóttir.
- Hilmar Finnsson (Reykjavik University), PhD student working on his thesis supervised by Yngvi Björnsson, formally affiliated with the Center for Analysis and Design of Intelligent Agents.
- Eugen-Ioan Goriac (Reykjavik University), PhD student working on his thesis supervised by Luca Aceto and Anna Ingólfsdóttir.
- Stefán F. Gudmundsson (Reykjavik University), PhD student working on his thesis supervised by Yngvi Björnsson, formally affiliated with the Center for Analysis and Design of Intelligent Agents.
- Ali Jafari (Reykjavik University), PhD student supervised by Marjan Sirjani.
- Kristján Valur Jónsson (Reykjavik University) who defended his thesis in December 2012, mentored by Magnús M. Halldórsson and from mid-2011 supervised by Ýmir Vigfússon.
- Jón Ingi Sveinbjörnsson (Reykjavik University), PhD student working on his thesis supervised by Bjarni Halldórsson.

Henning Úlfarsson supervised two MSc students in computer science during 2012 (one due to graduate in the spring 2013 and one in the spring 2014).

6 Publications by Members of the Centre

We already mentioned some of the research highlights earlier in this report. Here we limit ourselves to mentioning that the work carried out by the members of our research groups in algorithmics and combinatorics has been presented at some of the premiere conferences in those areas such as ICALP, SODA and PODC and in some of the top journals, such as the Journal of Combinatorics. Yngvi Björnsson's work on search-methods in artificial intelligence and on general game playing continues to have high visibility both nationally and internationally. Apart from being published in the top publication outlets in the area, some of that work has achieved wide recognition. Finally, ICE-TCS researchers published journal papers in outlets such as Mathematical Structures in Computer Science, Science of Computer Programming, Theoretical Computer Science and Information Processing Letters.

Since the time of writing the annual report for 2011, the members of ICE-TCS have published 12 journal papers and 15 conference and workshop papers. By way of comparison, in the previous reporting period the corresponding figures were of 14 journal papers and 24 conference and workshop papers. The drop in the number of publications is due to the decrease in the number of members of the centre and, perhaps, to the fact that some of the members of the centre might not report on their publications consistently.

Full details on the publications by members of the centre since its inception may be found at

http://www.icetcs.ru.is/publications.pdf.

7 Forthcoming Activities

During 2013, we plan to continue our work with the aim of achieving the objectives stated in Section 1. Despite the available funding and staffing, the levels of ambition and activity remain high within ICE-TCS, and we hope that 2013 will be as successful as 2012 was.

In spite of the lack of funding, we intend to maintain a vibrant visitor program, taking full advantage of the attractiveness that Iceland has as a travel destination.

The calendar year 2013 will be rich of events that see major involvement from ICE-TCS members. From January 2013, ICE-TCS organizes the Pearls of Computation seminar series, which continue the work from the highly successful Alan Turing Year events, see http://www.icetcs.ru.is/poco.html for

details. To begin with, the talks in this series will mostly focus on the work of some of the recipients of the ACM Turing Award (or of some other major award related to computer science) in an accessible way. The Pearls of Computation talks at Reykjavik University are organized in collaboration with the School of Computer Science at Reykjavik University, CADIA, "CRESS: Center on Research in Engineering Software Systems", the Icelandic Mathematical Society, IIIM and the Mathematics Group at Reykjavik University.

The new Bachelor program in Discrete Mathematics and Computer Science at Reykjavik University has been formally advertised and started officially in the autumn 2012. It will be interesting to see how many students will enroll in this study line over the coming years and how many of those will pursue undergraduate research opportunities or graduate studies in TCS.

As usual, we held our annual ICE-TCS Theory Day on 22 March 2013. The event featured invited talks by Pierluigi Crescenzi (University of Florence, Italy), Pierre Fraigniaud (CNRS and University of Paris 7, France) and Stephan Holzer (ETH Zurich, Switzerland).

Marjan Sirjani will once more represent ICE-TCS in the grant evaluation panel for Science and Engineering of the Icelandic Research Fund in 2013.

On January 23, 2013, Henning Úlfarsson was re-elected as president of the Icelandic Mathematical Society. He will also be one of the main organizers of the biennial conference of the Icelandic Mathematical Society, which will be held in the autumn of 2013.

At the time of writing, two of the three computer scientists inducted to the Icelandic Academy of Sciences are members of ICE-TCS. During 2013, we expect that more members of ICE-TCS will join that academy.

During 2013, Magnús M. Halldórsson will be an invited speaker at ALGOSENSORS 2013 (9th International Symposium on Algorithms and Experiments for Sensor Systems, Wireless Networks and Distributed Robotics), MAPSP '13 (11th Workshop on Models and Algorithms for Planning and Scheduling Problems) and at the 6th Annual Meeting of the AAAC in Matsushima, Japan. He will also deliver the doctoral course *Approximation Algorithms for Unweighted Graph Problems* at the 18th Estonian Winter School in Computer Science, EWSCS '13, Palmse, Estonia, 3–8 March 2013.

In early June 2013, ICE-TCS hosts Ice Break 2013, a six-day (PhD) course with emphasis on symmetric cryptography and with world-class lecturers.

In 2013, two of the PhD students affiliated with ICE-TCS, Georgiana Caltais and Eugen-Ioan Goriac, will defend their thesis.

We still think that it would be useful for the centre to undergo an evaluation by a high-profile panel of experienced researchers. Such an evaluation

would be used by the centre to obtain an objective evaluation of its achievements so far in relation to the available resources, as well as useful feedback for improving its activities and impact in the future.

8 Summary and Self-Evaluation

The reporting period has seen ICE-TCS continue to achieve a fair amount of visibility in the research community. The centre has been very active in organizing high-quality scientific events at Reykjavik University and some of its members have served as PC chairs and PC members of top-class conferences in theoretical computer science. Furthermore, members of ICE-TCS have taken up leadership positions in scientific organizations and steering committees. We consider this a sign of recognition for the research work that has been carried out within the centre, and for the role that the centre as a whole has played in the theoretical-computer-science community since its inception.

Scientifically, the centre has continued to play an important role in the computer-science and discrete mathematics communities in Iceland. As in previous years, the vast majority of the scientific events in those fields taking place in Iceland have been associated with the centre and, to the best of our knowledge, the ICE-TCS seminar series and guest program are pretty much unique in the country. Internationally, the centre has continued to contribute to the TCS community via its research output and its service activities. We feel that we can be proud of what has been achieved in 2012. However, as mentioned earlier, the yearly number of publications of the centre has decreased a little over the last couple of years. The trend is not worrying yet, since our research output is mostly still published in reputable outlets, but we will monitor the future developments in our publication patterns and in our reporting procedures. In particular, we will try to maintain a good rate of publications in journals and we are setting ourselves the goal of reaching the 200-journal-papers mark by the end of 2013.

During the reporting period, the centre has further extended its network of research collaborators, and we feel that we have taken good advantage of all the ad hoc funding opportunities that we have had available. We will continue to try and attract research visitors to ICE-TCS using every avenue at our disposal. ICE-TCS members will also continue applying for visiting professorships abroad.

The centre would benefit by having more students. We hope that the new degree course in Discrete Mathematics and Computer Science will give us a

chance to get talented students interested in the mathematical foundations of computer science from the start of their studies.

Overall, we feel that we can be pleased with the quality and the quantity of the research work carried out by our members, and with the ensuing publications. In keeping with the centre's ambitions, it will be a useful exercise for us to find ways to increase the influence and activities of ICE-TCS even further. However, growth in the centre's research activities will strongly depend on increasing the number of its permanent members and on the quality of the PhD. students and postdoctoral researchers that we will manage to attract. The main obstacles to attracting PhD. students and postdocs is the lack of funding, and we will have to do our best to be successful in grant-winning. We look forward to meeting the challenges ahead and to offering our contribution to the theoretical computer science community.