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17TH INTERNATIONAL CONFERENCE
ON COMPUTATIONAL SCIENCE AND
ITS APPLICATIONS

July 3-6, 2017

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Preface

These multiple volumes of LNCS and one proceeding in IEEE Xplore consist of the peer-reviewed papers from the 2017 International Conference on Computational Science and Its Applications (ICCSA 2017) held in Trieste, Italy on 3-6 July 2017.

ICCSA 2017 is a successful event in the International Conferences on Computational Science and Its Applications (ICCSA) conference series, previously held in Beijing, China (2016), Banff, Canada (2015), Guimares, Portugal (2014), Ho Chi Minh City, Vietnam (2013), Salvador, Brazil (2012), Santander, Spain (2011), Fukuoka, Japan (2010), Suwon, South Korea (2009), Perugia, Italy (2008), Kuala Lumpur, Malaysia (2007), Glasgow, UK (2006), Singapore (2005), Assisi, Italy (2004), Montreal, Canada (2003), and (as ICCS) Amsterdam, The Netherlands (2002) and San Francisco, USA (2001).

Computational Science is a main pillar of most of the present research, industrial and commercial activities and plays a unique role in exploiting ICT innovative technologies, and the ICCSA conference series have been providing a venue to researchers and industry practitioners to discuss new ideas, to share complex problems and their solutions, and to shape new trends in Computational Science.

Apart from the general tracks, ICCSA 2017 also include 43 international workshops, in various areas of computational sciences, ranging from computational science technologies, to specific areas of computational sciences, such as computer graphics and virtual reality. Furthermore, this year ICCSA 2017 hosts the XIV International Workshop On Quantum Reactive Scattering. The program also features 3 keynote speeches and 4 tutorials.

The success of the ICCSA conference series, in general, and ICCSA 2017, in particular, is due to the support of many people: authors, presenters, participants, keynote speakers, session chairs, organizing committee members, student volunteers, Program Committee members, International Advisory Committee members, International Liaison chairs and people in other various roles. We would like to thank them all.

We would also like to thank Springer for their continuous support to publish ICCSA conference proceedings.

July 2017.

O. Gervasi, B. Murgante, S. Misra, G. Borruso, C. Torre, A. M. Rocha,
D.Taniar, B. Apduhan, E. Stankova E, A. Cuzzocrea

ICCSA 2017 Volume Editors

Welcome to Trieste

We are honored and happy to have organized this extraordinary edition of the Conference, with so many interesting contributions, and participants coming from more than 46 countries in the world!

Trieste is a medium-size Italian city laying at the North Eastern Italy-Slovenia border. It counts nearly 200.000 inhabitants and faces the Adriatic Sea, surrounded by the Karst plateau.

It is a quite atypical Italian city, being its history very much influenced by the former belonging for several centuries to the Austrian Hungarian empire and having passed several foreign occupations in history: by French, Venetians, not lastly, the Allied Forces after the Second World War. Such events left several footprints on the structure of the city, on its buildings, culture and society!

During its history Trieste hosted people coming from different countries and regions, making it a cosmopolitan and open city. That was also helped by the presence of a commercial port that made it an important trade centre from the 18th century on. Trieste is known today as a City of Science or, more proudly, presenting itself as the City of Knowledge. That is due to the presence on its tiny territory of several universities and research centres, all of them working at international level, as well as of cultural institutions and traditions. The city presents a high presence of researchers, more than 35 over 1,000 employed people, much higher than the average European value of 6 employed researchers over 1,000 people.

The University of Trieste, at the origin of such a system of scientific institutions, dates back to 1924, although its roots are located in the end of the 19th century under the Austrian–Hungarian Empire. The University today employs nearly 1,500 among teaching, research, technical and administrative staff over a population of more than 16,000 students.

The university currently has 10 departments: Economic, Business, Mathematical and Statistical Sciences; Engineering and Architecture; Humanities; Legal, Language, Interpreting and Translation Studies; Mathematics and Geosciences; Medicine, Surgery and Health Sciences; Life Sciences; Pharmaceutical and Chemical Sciences; Physics; Political and Social Sciences.

We are sure that the participants will be overwhelmed by the cultural and scientific ferment of Trieste and will keep a special memory of the event, that will remain unforgettable in their hearts.

Giuseppe Borruso
ICCSA 2017 Local arrangement Chair

Message from Workshop Chairs of ICCSA 2017

On behalf of the 17th International Conference on Computational Science and Applications (ICCSA 2017), we warm welcome to all authors and workshop chairs in a very beautiful city of Italy- Trieste, during July 3-6, 2017.

This year ICCSA includes general track and 43 international workshops which offer to wide range of topics in specific areas of computational sciences. ICCSA 2017 is one of rare conferences where authors get two options of publication outlet- Lecture Notes in computer science and IEEE Xplore proceedings (post conference). In particular- The selected top quality theme papers and session papers having adopted LNCS, will appear in the Springer-Verlag Lecture Notes in Computer Science (LNCS) series and PHD showcase papers and the selected top quality session papers having adopted Xplore publication, will appear in the IEEE Xplore digital library. All the workshop chairs have option for choosing the publication outlet – either in LNCS of IEEE Xplore. In this particular volume of IEEE Xplore proceedings consists of papers from 9th International workshop on Tools and Techniques in Software Development Processes (TTSDP 2017) and papers from various workshops and general track of ICCSA 2017 -where authors adopted to publish their papers in IEEE Xplore.

The success of ICCSA 2017 is due to all workshop chairs and their team members- whose dedication and hard work made conference memorable and highly successful. We are highly thankful to all those researchers: authors, reviewers and International program committee members and all attendees, who gave their support to make this conference as successful event. Finally yet importantly, we are highly thankful to chair and member of Local organizing committee- without their fantastic arrangement (logistic, food, technical support and transportation), the conference could not be successful.

Once again you are welcome in Trieste, Italy in the great event of ICCSA 2017 .

Beniamino Murgante, University of Basilicata, Italy
Sanjay Misra, Covenant University, Nigeria
Jorge Gustavo Rocha, University of Minho, Portugal

ICCSA 2017 Workshop and Session Chair(s)

Message from Workshop Chair of 9th International Workshop on
Tools and Techniques in Software development Processes
(TTSDP) 2017

On behalf of the workshop committee of 9th International Workshop on Tools and Techniques in Software development Processes (TTSDP) 2017, I am delighted to welcome you all in this prestigious event. This year TTSDP 2017 will be held in a very beautiful city of Italy- Trieste, during July 3-6, 2017.

As like previous years, this year also TTSDP is associated with International Conference on Computational Sciences and Applications 2017 (ICCSA 2017). The TTSDP is only the workshop in the area of software engineering in ICCSA, which accepts all types of research contributions i.e. full length research articles, experience papers, case studies, working papers, industrial reports and short papers. The full-length research articles and experience reports, case studies are of 6-10 pages, while short papers, working papers and industrial reports are of 4-6 pages. The main aim of the TTSDP is to encourage the practitioners to share their real-world experience related to software development process with the academicians and researchers working in the area. Practitioners are the one who can better explain; raise the actual problems and issues, which they face in real environment.

By grace of All Mighty GOD, this year too, we have gotten very good response from the authors from all over the world. Thanks to the all authors who submitted their papers in this conference. Several high quality papers could not be accommodated in the workshop and we are really sorry for the concern authors. Some papers, which are not under the scope of the conference, are also not considered.

We are also giving the opportunity to the authors of all presented papers, to extend their work and submit for journal publication. More specifically, after presentation of the paper in TTSDP-2017, we invite you to extend your papers and will submit to me, if your extended versions will be found suitable, we will publish them. We have several international journals(SCIE and SCOPUS indexed) for publication of your papers.

We are highly thankful all the researchers: authors, reviewers and International program committee members and all attendees, who gave their support to make this conference as a highly successful event. Finally yet importantly, we thank Prof Osvaldo Gervasi, and Prof Beniamino Murgante for their continuous help and cooperation.

Once again you are welcome in Trieste, Italy during the great event of TTSDP 2017.

Sanjay Misra,
Covenant University, Nigeria

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