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Theoretical Aspects of Computing – ICTAC 2020

17th International Colloquium
Macau, China, November 30 – December 4, 2020
Proceedings

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Preface

This volume contains the proceedings of the 17th International Colloquium on Theoretical Aspects of Computing (ICTAC 2020), which was held virtually during November 30 – December 4, 2020. Established in 2004 by the International Institute for Software Technology of the United Nations University (UNU-IIST, now the United Nations University Institute in Macao), the ICTAC conference series aims at bringing together researchers and practitioners from academia, industry, and government to present research and exchange ideas and experience addressing challenges in both theoretical aspects of computing and the exploitation of theory through methods and tools for system development. ICTAC also specifically aims at promoting research cooperation between developing and industrial countries. The international COVID-19 situation made a physical international gathering in Macao impossible (although Macao as a city has an extremely low number of cases – alas partially due to travel restrictions). Nonetheless, we are grateful to our colleagues at the University of Macao who were originally involved in the organization and set to host the conference on their recently extended campus on Hengqin island.

We received a total of 40 full submissions, of which 15 were accepted for publication (14 regular papers and one tool paper). The acceptance rate was therefore 37.5%. Papers were assigned to four reviewers, with the reviewing phase being followed by discussions. Reviewing was single-blind. The program also included three keynote presentations from Klaus Havelund (Jet Propulsion Laboratory, California Institute of Technology, USA), Marieke Huisman (University of Twente, The Netherlands), and Naijun Zhan (State Key Lab. of Computer Science, Institute of Software, Chinese Academy of Sciences, China). This volume includes a full paper accompanying Klaus' keynote on "A Flight Rule Checker for the LADEE Lunar Spacecraft," and abstracts of Marieke's contribution on "Teaching Software Verification using Snap!," and Naijun's talk on "Taming delays in cyber-physical systems."

We are grateful for the support provided by the many people who contributed to ICTAC 2020, including the Steering Committee members, Ana Cavalcanti, the chair Martin Leucker, and Tarmo Uustalu. We would like to thank the members of the Program Committee and their sub-reviewers for their timely and high-quality reviews as well as their contributions to the discussions. The conference organization was partially supported by the Norwegian Research Council.

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November 2020

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Abstract of Invited Talks

Teaching Software Verification Using Snap!

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With the progress in deductive program verification research, new tools and techniques have become available to reason about non-trivial programs written in widely-used programming languages. However, deductive program verification remains an activity for experts, with ample experience in programming, specification, and verification. We would like to change this situation, by developing program verification techniques that are available to a larger audience. Therefore, in this presentation, we show how we developed program verification support for Snap!. Snap! is a visual programming language, aiming in particular at high school students. We support both static and dynamic verification of Snap! programs. Moreover, we also outline how program verification in Snap! could be introduced to high school students in a classroom situation.

Taming Delays in Cyber-Physical Systems

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With the rapid development of feedback control, sensor techniques, and computer control, time delay has become an essential feature of cyber-physical systems (CPSs), underlying both the continuous evolution of physical plants and the discrete transition of computer programs, which may well annihilate the stability/safety certificate and control performance of CPSs. In the safety-critical context, automatic verification and synthesis methods addressing time-delay in CPSs should therefore abound. However, surprisingly, they do not, although time-delay has been extensively studied in the literature of mathematics and control theory from a qualitative perspective. In this talk, we will report our recent efforts to tackle these issues, including controller synthesis for time-delayed systems in the setting of discrete time, bounded and unbounded verification of delay differential equations, and discuss remaining challenges and future trends.

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