REPORT ON ICALP 2020

47th International Colloquium on Automata, Languages and Programming

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The *47th International Colloquium on Automata, Languages and Programming (**ICALP 2020**)*, the flagship conference and annual meeting of the *European Association for Theoretical Computer Science (EATCS)*, took place from the 8th to the 11th of July 2020. The event was held (for the first time ever) *virtually*, as an online event hosted by the Saarland Informatics Campus in Saarbrücken, Germany. ICALP 2020 was co-located with the 35th Annual ACM/IEEE Symposium on Logic in Computer Science (LICS 2020).

The main conference was preceded by a series of workshops, which took place on July 6–7, 2020. This year, the following five workshops were held as satellite events of ICALP and LICS 2020:

- Algorithmic Aspects of Temporal Graphs (AATG),

- Verification of Infinite-State Systems (INFINITY),

- Logic and Computational Complexity Workshop (LCC 2020),

- Logic Mentoring Workshop (LMW),

- Programming Research in Mainstream Languages (PRiML).

The conference was affected by the outbreak of the coronavirus pandemic, and as the result, ICALP 2020 (with the co-located LICS 2020) was moved to the online format. The conference was originally planned to be chaired by Xiaotie Deng and take place in Beijing, China, but the early phase of the outbreak of COVID-19 led the Steering Committees of ICALP and LICS to move the organization to Saarbrücken, Germany, chaired by Holger Hermanns. After it later became transparent that the physical conference cannot happen, keeping the safety, health and well-being of ICALP participants as a top priority, the Steering Committees of ICALP and LICS, together with the organizers in Saarbrücken decided to run the conferences entirely online, and so we had the first online ICALP in 2020.

The scientific programme for ICALP 2020 consisted of 3 ICALP invited lectures, 2 joint ICALP-LICS invited lectures, the presentation of 138 contributed papers (which were selected by the Program Committees out of 470 submissions) and award sessions with the lectures of the Gödel Prize, the EATCS Award 2020, and the Presburger Award 2020 recipients.

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The online conference. The online conference was managed by the staff at the Saarland Informatics Campus, Saarbrücken, led by Holger Hermanns. The organizers in Saarbrücken did their very best to make the online conference a very smooth experience and a scientific feast for all the participants. The formal decision to move ICALP and LICS 2020 online was made in early April, leaving just over three months to plan the conference in this new environment. The organizers, with the cooperation from the ICALP and LICS Steering Committees and the PC chairs, decided to organize the conference in a new format relying on a combination of synchronous and asynchronous platforms:

- **Pre-recorded talks** for all regular papers to be presented at the conference; all talks were made freely available to all on YouTube one week before the start of the conference.

- A **Slack workspace** available for registered participants; this was intended as a place for dissemination of conference related information, for discussion on questions from talks, and as a platform for asynchronous communication between the participants.

- **Live Zoom paper sessions** and workshops at the conference; the sessions were recorded and made freely available for streaming on YouTube.

The core part of the conference were Zoom live sessions, defining a program around which the conference was structured. The live sessions were held daily (Wednesday – Saturday, July 8–11) between 12:00 or 12:30pm and 6pm or 7pm CEST. The live sessions included plenary events for the Opening Ceremony (and Best Video Awards), EATCS/ICALP/LICS Award sessions, EATCS General Assembly, and five invited presentations. This was complemented by parallel Q&A sessions for all accepted regular papers at ICALP, to allow the participants to engage in active discussions with the authors. The authors of the accepted papers were asked to prepare a short 3-5 minutes long presentation (in addition to 20-25 minutes long pre-recorded talk), and then to be available for any live questions, and also for any further online discussions on Slack.

Because the event was run online, the organizers were able to offer registration at a significantly reduced price compared to the normal cost. While ICALP registration costs are typically in excess of €400, this year there were two types of event participation: *paid registration* for €120 (€100 for ACM/SIG & IEEE members), and *free sign-up*. The paid registration was compulsory for authors, to contribute to the fixed costs of ICALP and to the proceedings costs. Most of the participants signed-up for the free registration with the access to all sessions and workshops. This resulted in the highest ever number of participants, 679 registrants to ICALP (172 paid registrations and 507 free ones), and a total of 1268 registrations for the entire joint ICALP-LICS event, including workshops.

In a separate paper in this issue of the Bulletin (Felix Freiberger and Holger Hermanns, *LICS-ICALP 2020 Questionnaire Evaluation*), the organizers provide some more comments about the challenges faced by the organization of online conferences, and the outcome of a questionnaire for the ICALP-LICS 2020 participants.

On behalf of the entire community, we warmly thank the organizers in Saarbrücken for their flexibility and adaptability in this difficult situation and for their fantastic efforts that helped to make this conference a great success.

Paper selection and work of the Program Committee. After 15 years running the ICALP conference with three tracks, and after long and extensive deliberation in the ICALP community, it was decided to return to a two-track format in ICALP 2020. The topics previously included in Track C have been incorporated into Track A. As the result, the ICALP 2020 program had the following two tracks:

- Track A: Algorithms, Complexity, and Games.

- Track B: Automata, Logic, Semantics, and Theory of Programming.

The PC chairs for the two tracks of ICALP 2020 were Artur Czumaj (Track A) and Anuj Dawar (Track B). Their efforts were supported by 63 members of the Program Committee (40 in track A and 23 in track B). Because of the COVID-19 pandemic, the deadline of submissions was extended by six days (to February 18), when it was decided that the conference would move from Beijing to Saarbrücken. In response to the call for papers, a total of 470 submissions were received: 347 for Track A and 123 for Track B (all time record for ICALP Track B). Each submission was assigned to at least three Program Committee members, aided by 857 external subreviewers. Despite the extended deadline and hence shortened reviewing and discussion period, and various distractions to many PC members and subreviewers caused by the coronavirus pandemic, the Program Committee made a fantastic job to finalize the selection on time. At the end, the Program Committee decided to accept 138 papers for inclusion in the scientific program: 102 papers for Track A and 36 for Track B. This gives the acceptance rate for the entire conference and for each track to be 29%. The selection was made by the Program Committees based on originality, quality, and relevance to theoretical computer science. The quality of the submitted manuscripts was very high, and unfortunately many strong papers could not be selected. We take this opportunity of thanking all of them, the Program Committees and the subreviewers for doing an exceptional job.

Statistical information about the number of papers submitted and accepted for the last several editions of the ICALP conference, as well as acceptance rates, are

	2020	2019	2018	2017	2016	2015	2014	2013	2012
Total	470	490	502	459	515	507	477	423	433
Track A	347	316	346	296	319	328	312	249	249
Track B	123	103	96	108	121	114	106	114	105
Track C	—	71	60	55	75	65	59	60	79

Table 1: Number of submitted papers at ICALP 2012–2020.

	2020	2019	2018	2017	2016	2015	2014	2013	2012
Total	138	146	147	137	146	143	136	124	123
Track A	102	94	98	88	89	89	87	71	71
Track B	36	31	30	32	36	34	31	33	30
Track C	—	21	19	17	21	20	18	20	22

Table 2: Number of accepted papers at ICALP 2012–2020.

available in Tables 1–3. The breakdown by country for each track of ICALP 2020, limited to the top ten countries by number of submissions, is in Tables 4–5.

Invited presentations. In addition to the contributed talks, ICALP 2020 featured three invited presentations by Stefan Kiefer (Track B), Robert Krauthgamer (Track A), and Virginia Vassilevska Williams (Track A), and two invited talks joint with LICS 2020, by Jérôme Leroux and Andrew Chi-Chih Yao:

- Stefan Kiefer (Oxford University): *How to Play in Infinite MDPs*.

- Robert Krauthgamer (The Weizmann Institute of Science): *Sketching Graphs and Combinatorial Optimization*.

- Jérôme Leroux (Bordeaux University): *When Reachability Meets Grzegorczyk*.

- Virginia Vassilevska Williams (MIT): *The Graph Diameter Problem — Approximation Algorithms and Fine-grained Lower Bounds*.

- Andrew Chi-Chih Yao (Tsinghua University): *An Incentive Analysis of Some Bitcoin Fee Designs*.

	2020	2019	2018	2017	2016	2015	2014	2013	2012
Total	29.4	29.8	29.3	29.8	28.3	28.2	28.5	29.3	28.4
Track A	29.4	29.7	28.3	29.7	27.9	27.1	27.9	28.5	28.5
Track B	29.3	30.1	31.3	29.6	29.8	29.8	29.2	28.9	28.6
Track C	—	29.6	31.7	30.9	28.0	30.8	30.5	33.3	27.8

Table 3: Acceptance rates (in %) for ICALP 2012–2020.

country	submitted	accepted	accept. rate	authors	PC members
United States	89.54	30.17	0.34	227	8
Germany	48.05	11.61	0.24	113	5
Israel	24.30	8.08	0.33	50	4
China	23.00	5.33	0.23	72	2
India	21.73	3.60	0.17	49	0
United Kingdom	18.10	8.27	0.46	48	4
France	15.5	2.83	0.18	42	1
Japan	12.86	4.25	0.33	30	1
Canada	12.11	4.81	0.40	37	1
Netherlands	9.45	3.83	0.41	18	1

Table 4: ICALP 2020: Breakdown by country (Track A).

ICALP Proceedings.   As it has been the tradition since 2016, ICALP proceedings were published with *LIPIcs*. *LIPIcs – Leibniz International Proceedings in Informatics* is a series of high-quality conference proceedings across all fields in informatics established in cooperation with Schloss Dagstuhl–Leibniz Center for Informatics. All 138 ICALP 2020 contributed papers presented at the conference, papers accompanying the invited talks of Stefan Kiefer and Andrew Yao, and an abstract of the invited presentation of Robert Krauthgamer, were published according to the principle of Open Access in LIPIcs Proceedings volume 168, and made available online and free of charge at `https://drops.dagstuhl.de/opus/portals/lipics/index.php?semnr=16154`. The proceedings editors are Artur Czumaj, Anuj Dawar, and Emanuela Merelli.

ICALP and EATCS Awards.   The EATCS sponsors awards for both a best paper and a best student paper in each of the two tracks at ICALP, as selected by the Program Committees. During the general assembly, the ICALP Best Paper and Best Student Paper Awards were presented to the authors of the following papers:

country	submitted	accepted	accept. rate	authors	PC members
Germany	25.74	7.95	0.31	54	3
France	19.57	5.24	0.27	43	6
United Kingdom	19.32	8.03	0.42	45	5
United States	10.35	3.83	0.37	26	1
Poland	9.18	4.03	0.44	20	1
Israel	4.50	0.25	0.06	8	0
India	4.24	0.33	0.08	12	1
Austria	3.23	1.10	0.34	9	0
Italy	3.12	1.17	0.38	9	0
China	2.92	1.00	0.34	11	1

Table 5: ICALP 2020: Breakdown by country (Track B).

Best Paper in Track A: Paweł Gawrychowski, Shay Mozes, and Oren Weimann. *"Minimum cut in $O(m \log^2 n)$ time."*

Best Paper in Track B: David Barozzini, Lorenzo Clemente, Thomas Colcombet and Paweł Parys. *"Cost automata, safe schemes, and downward closures."*

Best Student Paper in Track A: Aditya Potukuchi. *"A spectral bound on hypergraph discrepancy."*

Best Student Paper in Track B: Erik Paul. *"Finite sequentiality of finitely ambiguous max-plus tree automata."*

The organizers and the Program Chairs awarded also the ICALP Best Video Award for the most interesting video of the presentation at the conference:

Best Video Award: for Radosław Piórkowski for the video presentation accompanying the paper *"Timed games and deterministic separability,"* co-authored by Lorenzo Clemente and Sławomir Lasota.

The program of ICALP 2020 included presentations of several prestigious scientific awards sponsored or co-sponsored by EATCS:

- The **Gödel Prize 2020** for outstanding papers in the area of theoretical computer science was awarded to **Robin A. Moser and Gábor Tardos** for their algorithmic version of the Lovász Local Lemma in the paper "A constructive proof of the general Lovász Local Lemma," *Journal of the ACM* 57(2):

11:1-11:15 (2010). The award was presented jointly by ACM SIGACT and the EATCS.[3]

- The **EATCS Award 2020**, the annual EATCS Distinguished Achievements Award given to acknowledge extensive and widely recognized contributions to theoretical computer science over a life long scientific career, was awarded to **Mihalis Yannakakis** (Columbia University) for his fundamental and deep contributions to an extraordinary range of areas in theoretical computer science, including algorithms, complexity theory, combinatorial optimization, databases, and verification.[4]

- The **Presburger Award 2020** for Young Scientists was awarded to **Dmitriy Zhuk** (Lomonosov Moscow State University) for solving in his paper "A proof of the CSP Dichotomy Conjecture" one of the most important and difficult problems in the theory of computation: the CSP dichotomy conjecture of Feder and Vardi. The paper was a co-winner of the Best Paper Award at the FOCS 2017 conference and appeared in *Journal of the ACM* 67(5): 30:1–30:78 (2020).[5]

- The **EATCS Distinguished Dissertation Awards 2019**, to promote and recognize outstanding dissertations in theoretical computer science were awarded to three researchers:

  - **Josh Alman** for his dissertation *Linear Algebraic Techniques in Algorithms and Complexity*, advised by Ryan Williams and Virginia Vassilevska Williams at MIT,

  - **Sándor Kisfaludi-Bak** for his dissertation *ETH-Tight Algorithms for Geometric Network Problems*, advised by Mark de Berg and Hans L. Bodlaender at TU Eindhoven,

  - **Jakub Tarnawski** for his dissertation *New Graph Algorithms via Polyhedral Techniques*, advised by Ola Svensson at EPFL.

- The EATCS has recognized three of its members for their outstanding contributions to theoretical computer science by naming them **EATCS Fellows** class of 2020:

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[3]The full citation for the Gödel Prize 2020 is available at `https://eatcs.org/index.php/component/content/article/1-news/2850-2020-03-31-12-11-16`.

[4]The laudatio for the EATCS Award 2020 is available at `https://eatcs.org/index.php/component/content/article/1-news/2847-the-eatcs-award-2020-laudatio-for-mihalis-yannakakis`.

[5]The full laudatio for the Presburger Award 2020 is available at `https://eatcs.org/index.php/component/content/article/1-news/2859-presburger-award-2020-laudatio-for-dmitriy-zhuk-`

– **Pierpaolo Degano** (Università di Pisa) for his contributions in concurrency theory and applications in security and for biological systems.

– **Mohammad Taghi Hajiaghayi** (University of Maryland) for his contributions to the theory of algorithms, in particular algorithmic graph theory, game theory, and distributed computing.

– **Magnús Már Halldórsson** (Reyjavik University) for his contributions to the theory of approximation and graph algorithms as well as to the study of wireless algorithmics.

The recipients of the Gödel Prize 2020 (Robin A. Moser and Gábor Tardos), the EATCS Award 2020 (Mihalis Yannakakis), and of the Presburger Award 2020 (Dmitriy Zhuk) gave online presentations in the Award Sessions at ICALP 2020.

We congratulate all the winners and we hope their achievements will put the highlights of research in theoretical computer science in the spotlight, and will serve as inspirations to young researchers in the years to come.

We hope that this conference report gives you a glimpse of the rich scientific and social programme that made the 47th ICALP an unforgettable conference. Everyone involved in the organization of ICALP 2020 deserves the warmest thanks from the TCS community.

We wish to thank all authors who submitted extended abstracts for consideration, the Program Committees for their effort, and all the referees who assisted the Program Committees in the evaluation process. We are also grateful to the Conference Co-Chairs Xiaotie Deng and Holger Hermanns and all the support staff of the Organizing Committee for organizing ICALP 2020: to our colleagues in Peking University, led by Xiaotie Deng, for their organizational efforts in the originally planned location in Beijing, and to the colleagues from Saarbrücken, led by Holger Hermanns, who generously accepted the challenging task of organizing the conference at short notice, and who were then ready to run the conference online. We also want to thank CPEC — Center for Perspicuous Computing and Saarland University in Saarbrücken for their generous support for the conference. Finally, we are grateful to all members of the TCS community who offered their support in this difficult situation.

The General Assembly of the EATCS was informed about the progress of the organization of the *48th International Colloquium on Automata, Languages and Programming*, ICALP 2021, that will take place in Glasgow, Scotland, on July 12–16, 2021, with Simon Gay as the general chair for the conference. We hope to be able to run a normal physical conference, but we will monitor the global travel situation and consider whether the conference will be physical, virtual or hybrid. If there is a physical component, remote participation for both speakers and attendees will also be an option. The ICALP 2021 Program Committee Chairs

are Nikhil Bansal (Track A) and James Worrell (Track B). The ICALP 2021 call for papers is available at `http://easyconferences.eu/icalp2021/`.

We hope that you will make plans to submit your best work to ICALP 2021 and be able to go to Glasgow for the conference. We look forward to seeing you there.