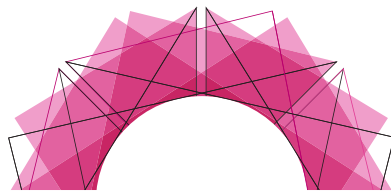


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Conference Proceedings



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2017

Celebrating the 20th Annual Bridges Conference
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Waterloo, Ontario, Canada



Proceedings 2017

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ISBN: 978-1-938664-22-9

ISSN: 1099-6702

Published by Tessellations Publishing, Phoenix, Arizona, USA (© 2017 Tessellations)

Distributed by *MathArtFun.com* (mathartfun.com).

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Preface

Welcome to the 20th Bridges conference! This year the conference is being held at the University of Waterloo in Waterloo, Ontario, Canada. It is an auspicious year to visit Waterloo: 2017 marks the 50th anniversary of the School of Computer Science (which began life as the Department of Applied Analysis and Computer Science) and of the Faculty of Mathematics. It is also the 60th anniversary of the university, not to mention the 150th anniversary of the country. Bridges 2017 marks our third time in Canada and our first visit to Eastern Canada, after the 2005 and 2009 conferences in Banff, Alberta. We are grateful that the Faculty of Mathematics has chosen to host this conference, and we hope that you will have an opportunity to soak up some of the anniversary spirit in the air on campus.

This year's Bridges Program Chair is David Swart. He coordinated an international Program Committee of over 50 experts who provided extensive reviews and editorial comments on submissions. He also served as chair of the regular paper track. Carlo Séquin chaired the short papers track with much help from Douglas M. McKenna. Kristóf Fenyvesi chaired the workshop submissions. Many thanks go to the members of the Program Committee who reviewed the large number of papers received. Special thanks go to Bianca Violet, our Short Film Festival Chair; Aubin Arroyo Comacho, Ana Cristina Oliveira, Kim Davidson, Chantal Landry, and Jos Leys, who served as the jury for the movie festival; Sarah Glaz, the Poetry Reading Chair; and to Kristóf Fenyvesi for organizing the public Family Day.

The 2017 edition of the Bridges proceedings includes 44 regular papers, 47 short papers, and 12 workshop papers. A wide range of topics are explored in this publication: you will find new work on visual art: both 2D (tiling, polygons, space-filling curves, cellular automata, fractals, knots) and 3D (polyhedra, surface modelling, magnetic packing) using a variety of media (including digital media, paper constructions, block printing, fiber arts, 3D printing, and weaving). There are papers that make connections between mathematics and literature, poetry, music, dance, opera, and acrobatic performance. There are discussions on mathematical art, artists, exhibits and competitions. And of course there are topics in mathematical visualization and in mathematics and art in education. Thank you to all of the authors and reviewers for their generous contributions to this year's proceedings, with special thanks to Eve and Bruce Torrence, Craig Kaplan, Carlo Séquin, and Kristóf Fenyvesi for their guidance and advice. We would also like to acknowledge the efforts of George Hart and Douglas M. McKenna and who provided extra support.

This year we were able to offer \$10,000 USD in student travel scholarships to 13 students from around the world who authored accepted papers and created mathematical artworks. We are very grateful to Jade Vinson for his generous contribution, which made this program possible, and to Sujan Shrestha who managed the program.

An exhibition of mathematical art has been an annual feature of Bridges since 2001. This year's exhibition sets a new record for the number of participating artists, over 170. Artists from

Europe, Africa, East Asia, Australia, and North and South America will be represented. A wide variety of artistic media are included in the exhibition, including 2D and 3D digital prints, painting, beadwork, ceramics, wood, metal, quilting, clothing, and paper folding. Artists drew inspiration from the mathematics of fractals, polyhedra, non-Euclidean and four-dimensional geometry, tiling, knot theory, number theory, and more. This year Katie McCallum and Robert Fathauer served as co-curators of the exhibition. Katie was joined by Krista Blake, Conan Chadbourne, Karl Kattchee and Marty Levin to make up the jury. The print catalog was prepared by Conan Chadbourne, and the art submission website was created and administered by Nathan Selikoff. Amy Aldous and Craig Kaplan were the local coordinators in Waterloo for the art exhibition.

Many people contributed to the organization and development of this year's conference. Thanks go first to Kelly Booth and Vic DiCiccio, who initially proposed (in 2013!) that Bridges 2017 be held in Waterloo. Thanks to Ian Goulden, the former Dean of Mathematics, for enthusiastically agreeing to support this project, and to Stephen Watt, the current Dean, and Mark Giesbrecht, Director of Computer Science, for their continuing support. We received a great deal of helpful advice and input from our campus-spanning Advisory Committee, consisting of Professors Linda Carson, Benoit Charbonneau, Rob Gorbet, Rick Haldenby, Ruxandra Moraru, J.P. Petti, and Dan Vogel. Thanks also to Andrew Houston, Ivan Jurakic, Doug Kirton, and Mark Vuorinen for dedicating time and resources to offer on-campus partner events. We also appreciate the many productive discussions with Andrew Bennett, Krista Blake, Luisa D'Amato, Greg Dick, Bob Egan, Tom Reitz, Brent Wettlaufer, and Graham Whiting about ways to integrate Bridges into the Kitchener-Waterloo community. We are grateful for the fundraising support provided by Ingrid Town, Mark Womack, and especially the tireless and enthusiastic Cynthia Fobert. Sara Leblanc was responsible for the lovely graphic design behind Bridges 2017, including our logo, postcards, posters, and book covers. Finally, our heartfelt thanks go to the staff who provided monumental organizational support and marshalled university resources in support of the conference: Anna Beard and Brittany Ottewill, and most especially the amazing Amy Aldous.

We gratefully acknowledge the support of our sponsors in making Bridges 2017 possible. Thanks to the City of Waterloo, the Fields Institute, and the Musagetes Fund for their generosity in helping to make the conference an exciting and memorable experience for all.

The past year has been a difficult and sometimes painful period of transition, as we have adjusted to the loss of our founder and leader, Reza Sarhangi. We miss his infectious enthusiasm, and recognize more than ever the superhuman effort he put into organizing a successful conference year after year. Reza's spirit lives on within Bridges; indeed, when making executive decisions, the board was often guided by a simple principle: "What would Reza do?". We believe that he would be delighted with this year's program, and we are committed to preserving his legacy by offering an inspiring and exciting conference for many years to come.

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