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# Preface

Welcome to the 28th annual Bridges Conference! This year's conference will take place at Eindhoven University of Technology (TU/e) in the Netherlands. TU/e was founded in 1956 to meet the engineering demands of a rapidly industrializing region. It has grown into an internationally recognized research university with a strong focus on science, technology, and design. Deeply rooted in collaboration with industry and society, the university has long been a driving force behind breakthroughs in electronics, mobility, and sustainability, and is consistently ranked among the world's top universities in terms of industry collaboration and societal impact.

TU/e is home to a unique blend of disciplines that intersect technology with creativity—particularly within the departments of Mathematics and Computer Science, the Built Environment, and Industrial Design. The mathematics department boasts a rich heritage, having been home to luminaries such as N.G. de Bruijn, known for the De Bruijn sequences, and Edsger W. Dijkstra, a pioneer in computer science and recipient of the 1972 Turing Award. The department continues to excel, with its Master's program in Industrial and Applied Mathematics being the first outside North America to receive the prestigious INFORMS UPS George D. Smith Prize in 2022, recognizing excellence in preparing students for careers in operations research and analytics. The department of the Built Environment is renowned for integrating architecture, urban planning, and building physics with computational and generative design approaches. Meanwhile, the Industrial Design department pioneers research and education at the interface of design, human-computer interaction, and data-driven systems, emphasizing aesthetics, interactivity, and social relevance. Together, these departments embody the spirit of Bridges: connecting disciplines, cultures, and modes of thinking through shared patterns, structures, and imagination.

Eindhoven was once a modest village on the banks of the Dommel River, It underwent a remarkable transformation in the 20th century, growing into a thriving city at the forefront of technological innovation and design. Its explosive growth began in the late 1800s with the rise of Philips Corporation, which turned the city into a powerhouse of electrical engineering and industrial development. Today, Eindhoven stands as the beating heart of the Brainport region—a world-class tech hub where cutting-edge companies like ASML, NXP, and countless startups thrive alongside a vibrant academic community that includes not only Eindhoven University of Technology, but also Fontys University of Applied Sciences, with its strong emphasis on practice-oriented education, and the internationally acclaimed Design Academy Eindhoven, known for producing leading voices in contemporary design. Visitors can explore the city's unique fusion of industry and imagination through landmarks such as the Evoluon, a retro-futuristic dome originally built by Philips as a science museum (featured on the cover), and the Van Abbemuseum, one of Europe's leading museums of modern and contemporary art. The Dommel, still flowing quietly through the city, connects past to present as Eindhoven continues to reinvent itself as a dynamic nexus of technology, creativity, and culture.

We are grateful for the financial support received from TU/e, in particular from the department of Mathematics and Computer Science for the conference as a whole and from the department of Industrial Design for the Math+Fashion Show. The department of Built Environment facilitated the Bridges Art Exhibition. The Academy of the Arts from Fontys University of Applied Sciences in Tilburg contributed to the Math+Fashion Show program. We also kindly acknowledge the generous financial support of the M.C. Escher Foundation. From the local organizing committee, we would in particular like to thank Natasja Betting–van Liempt, Loe Feijs, Sergio M. Figueiredo, Tijn Borghuis, and Tom Goris as key figures, as well as many other volunteers, some of whom came from the Foundation Ars et Mathesis, the Dutch counterpart of Bridges.

This year's papers were expertly edited by Tom Verhoeff, who chaired the Regular Papers program, David Swart, who chaired the Short Papers program, S. Louise Gould, who chaired the Workshop Papers program,

and Eve Torrence, who served as managing editor. They were supported by an international Program Committee of over 80 experts, who provided extensive peer reviews and editorial comments on submissions. Special thanks to Math + Fashion co-chairs Uyen Nguyen and Susan Goldstine, Poetry Reading chair Sarah Glaz, Theater Event chair Donald Spector, Short Film Festival chair and Theater Event co-chair Susan Gerofsky, and Family Day chair Carolyn Yackel. Thank you to Tiffany Inglis for designing the covers for the Proceedings and the Art Exhibition catalog, and many thanks to Craig S. Kaplan for production of this Proceedings and the Bridges Archive.

The 2025 Bridges proceedings includes 7 invited papers, 46 regular papers, 47 short papers, and 12 workshop papers. These papers cover a wide range of topics, including music, dance, poetry, algorithmic art, polyhedra, sculpture, fractals, tilings, space-filling curves, topology, symmetry, map coloring, and paradoxical figures. Fiber arts have a strong presence with contributions on using mathematics to study and enhance fashion, weaving, cross stitch, crochet, sewing, and string art. Traditional arts and crafts from around the world are presented, such as girih patterns, origami, muqarnas, rangoli, hitomezashi, and Balinese and Bharatanatyam dance. Several papers discuss M.C. Escher's work and his connections to Eindhoven. Creative mazes, puzzles, and games are introduced. Artists write about their work in a variety of media, from wood and paper to Rubik's cubes and holograms. An exciting mix of workshops discuss mathematical aspects of puppetry, poetry, polyhedra, coded embroidery, magic squares, and labyrinths.

A juried exhibition of mathematical art, craft, and design has long been an annual feature of Bridges. The exhibition showcases artifacts that express mathematical themes visually. Artisans and craftspeople from around the world participate, representing diverse cultural backgrounds and incorporating a wide variety of media, from painting and digital prints to textiles, paper folding, holograms, and geometric sculpture. This year's participants drew inspiration from many sources, but the influence of the Dutch artist M.C. Escher permeates many of the works. This year Bruce Torrence and Robert Fathauer served as co-curators of the exhibition. Rachel Quinlan and Sergio M. Figueiredo served on the jury along with the curators, and Sergio provided both expertise and logistical support for the installation of the exhibition. The art submission website and the online galleries were administered by Nathan Selikoff, while Conan Chadbourne prepared the Art Exhibition catalog.

We are grateful to the Bridges community for supporting the Reza Sarhangi Travel Scholarship and Memorial Lecture Fund. Thanks to these generous donations, we were able to offer 8 travel scholarships and 19 complimentary registrations for students to participate in the conference this year. It is a pleasure to celebrate Reza's vision of a vibrant international mathematical arts community with these scholarships for the next generation of mathematical art enthusiasts.

We had a record number of paper submissions again this year. The increasing popularity of the Bridges conference is wonderful to see. But this increased interest also strains the resources of the conference, particularly the extensive work that goes into reviewing the submissions. While we cannot accept every paper, we do give every author extensive feedback on their work. Even if a paper is not selected for this year's conference, the paper's authors and reviewers learn and grow from the experience. Much knowledge is shared and mathematical art is explored not just at the conference, but during all the work that goes into creating a Bridges conference.

We are delighted to welcome you to Eindhoven University of Technology this July to celebrate mathematics and the arts!

The Bridges Organization Board of Directors and Bridges 2025 Chairs
https://www.bridgesmathart.org