

Renaissance Banff II

# BRIDGES BANFF

Mathematics, Music, Art,  
Architecture, Culture

## 2009 Program



The Bridges  
Organization



Banff International  
Research Station



The Banff  
Centre

## **Bridges 2009 Program Notes**

Welcome to the twelfth annual Bridges conference. We are delighted to have so many excellent speakers and participants at the conference. We hope you find this meeting to be both enjoyable and inspirational.

Except for the excursion on July 28th, the mornings will be devoted entirely to Plenary Sessions, held in the Max Bell Auditorium. In the afternoons, participants will have a choice from among regular and short paper sessions and workshops, all held in the Max Bell Building.

All paper sessions have designated chairs. The chair's duties are to keep their session on schedule, to introduce the speakers, and (if necessary) to act as a moderator for any questions that follow a presentation. Of course, all participants are asked to lend their cooperation and support to this process, in order that the sessions might proceed as smoothly as possible. Before the beginning of a session, speakers should introduce themselves to the chair and provide them with a few words to use as an introduction (or, at the very least, the correct pronunciation of the speaker's name).

Regular and short paper presentations are scheduled for 25 and 10 minutes, respectively, including time for questions. All presentations are separated by 10-minute breaks to give participants a chance to change rooms. If necessary, a speaker may take up to an extra five minutes for their talk. Presenters who feel that they will need this extra time should advise the chair at the start of the session. Chairs, please ensure that there is always at least five minutes between consecutive talks.

The workshops were conceived and designed to benefit educators. However, they may be of interest and benefit to all participants. Everyone should seek the best combinations of workshops and paper sessions that fit their individual needs and interests.

All rooms will be equipped with data projectors. Presenters will be responsible for bringing (or borrowing) computers to from which to give talks.

Welcome to Bridges. We hope you enjoy the conference.

# Week-long Events

## Zome Sculpture (all week)

Zometool and friends of Chris Kling are sponsoring a week-long project dedicated to the work and memory of Chris Kling, in which participants will help construct a never-before-realized architectural fantasy using nearly 50,000 Zometool components and resulting in a structure 15' (nearly 5 meters) in diameter.

Everyone is welcome on a drop-in basis to participate in this rewarding experience.

## Bridges Visual Art Exhibition (all week)

An exhibition of 2D and 3D mathematical art, curated by Robert Fathauer

## Sunday, July 26th: Full program

July 26th, Morning (9:00–12:00)	
Plenary Talks I Max Bell Auditorium Chair: <b>Craig S. Kaplan</b>	
9:00–9:30	<b>Welcome</b> <i>Bridges Banff Scientific Organizers</i>
9:30–10:15	Plenary Talk: <b>Mathematics is Art</b> <i>Erik Demaine</i>
10:30–11:15	Plenary Talk: <b>Growth Forms</b> <i>George Hart</i>
11:30–12:00	<b>Art Exhibition opening and reception, supported by the Journal of Mathematics and the Arts</b>
Lunch (12:00–2:15)	
July 26th, Afternoon (2:15–6:05)	
Paper sessions and workshops <i>See next page for detailed afternoon schedule.</i>	
Dinner (6:05–8:00)	
July 26th, Evening (8:00–10:00)	
<b>Bridges Presentation and Movie Night</b> Max Bell Auditorium	
A screening of <i>Between the Folds</i> , an award-winning 2008 documentary about the art and science of paperfolding. Features invited speakers Erik Demaine and Robert Lang, attendee Chris Palmer, and others.	

# Sunday, July 26th: Paper sessions and workshops

July 26th, Afternoon (2:15–6:05)		
<p>Regular Papers I: <b>Music &amp; Dance</b>            Chair: <b>Vi Hart</b>            Location: <b>Max Bell Auditorium</b></p> <p>2:15–2:40 Tiling the Musical Canon with Augmentations of the Ashanti Rhythmic Pattern  <i>Carl Bracken, Gary Fitzpatrick and Nadya Markin</i></p> <p>2:50–3:15 Harmonious Dances  <i>Karl Schaffer</i></p> <p>3:25–3:50 Symmetry and Transformations in the Musical Plane  <i>Vi Hart</i></p>	<p>Regular Papers II: <b>Teaching &amp; Creativity</b>            Chair: <b>Benjamin Wells</b>            Location: <b>Max Bell Room 159</b></p> <p>2:15–2:40 Marking a Physical Sphere with a Projected Platonic Solid  <i>Carolyn Yackel</i></p> <p>2:50–3:15 Spirograph Patterns and Circular Representations of Rhythm: Exploring Number Theory Concepts Through Visual, Tangible and Audible Representations  <i>Susan Gerofsky, Francisco Gomez, David Rappaport and Godfried Toussaint</i></p> <p>3:25–3:50 Bridging Art Museums and Middle School Math Classrooms  <i>Benjamin Wells and Philip Wagner</i></p>	<p>Workshops I            Coordinated by <b>Mara Alagic and Paul Gailiunas</b>            Location: <b>Max Bell Room 252</b></p> <p>2:15–3:25 The Beautiful Triangle  <i>Greg Beiles and Daphne Rosenwald</i></p> <p>3:35–4:45 A Workshop to Build Three Simple Tensegrity Models for K-12 Mathematics Classrooms  <i>Robert McDermott</i></p>
Break (4:00–4:30)		
<p>Regular Papers III: <b>Smaller &amp; Smaller</b>            Chair: <b>Douglas Dunham</b>            Location: <b>Max Bell Auditorium</b></p> <p>4:30–4:55 A Garden of Statistically Self-Similar Plants  <i>Anne Burns</i></p> <p>5:05–5:30 The Art of Iterated Function Systems with Expanding Functions  <i>Philip Van Loocke</i></p> <p>5:40–6:05 The Symmetry of “Circle Limit IV” and Related Patterns  <i>Douglas Dunham</i></p>	<p>Short Papers I            Chair: <b>Sandy Spitzer</b>            Location: <b>Max Bell Room 159</b></p> <p>4:30–4:40 Mathematical Classroom Quilts  <i>Elaine F. Ellison</i></p> <p>4:50–5:00 Honors Seminar: A Creative Interdisciplinary Approach for Student Exploration  <i>Gail Kaplan</i></p> <p>5:10–5:20 An Interdisciplinary First Seminar on Symmetry  <i>Tamara Lakins</i></p> <p>5:30–5:40 Using Geometer’s Sketchpad to Construct Pop-up Polyhedra as a Tool for Classroom Study of Geometry  <i>S. Louise Gould</i></p> <p>5:50–6:00 Geometry and Geodesy: Estimating the Earth’s Circumference with Prospective Elementary Teachers  <i>Sandy Spitzer</i></p>	<p>4:55–6:05 Bridges 09 Interactive Workshop: The Geometry of Longsword and Rapper Sword Locks  <i>Susan Gerofsky</i></p>

# Monday, July 27th: Full program

## July 27th, Morning (9:00–12:00)

Plenary Talks II  
Max Bell Auditorium  
Chair: **Carlo Séquin**

- 9:00–9:45      Plenary Talk: **Mathematical Methods in Origami Design**  
*Robert J. Lang*
- 10:00–10:45    Plenary Talk: **Using Turtles and Skeletons to Display the Viewable Sphere**  
*David Swart*
- 11:00–11:45    Plenary Talk: **Arca Musarithmica: A Pair of Curious Music Boxes**  
*Jim Bumgardner*

## Lunch (12:00–2:15)

## July 27th, Afternoon (2:15–6:05)

Paper sessions and workshops  
*See next page for detailed afternoon schedule.*

## Dinner (6:05–7:30)

## July 27th, Evening (7:30–10:00)

Evening Program

- 7:30–9:00      **JMA Editorial Meeting**  
*Hosted by Gary Greenfield (by invitation only)*
- 9:00–10:00    **Bridges General Discussion**  
*Hosted by Craig S. Kaplan, open to all Bridges participants*

# Monday, July 27th: Paper sessions and workshops

July 27th, Afternoon (2:15–6:05)		
<p>Regular Papers I: <b>2D Patterns</b>            Chair: <b>Susan McBurney</b>            Location: <b>Max Bell Auditorium</b></p> <p>2:15–2:40 Aesthetically Pleasing            Azulejo Patterns  <i>Russell Hendel</i></p> <p>2:50–3:15 The Unique Eleven-            Pointed Star Polygon            Design of the Topkapı            Scroll  <i>B. Lynn Bodner</i></p> <p>3:25–3:50 On Constructing a Virtual            Loom  <i>Susan McBurney</i></p>	<p>Regular Papers II: <b>Visualization &amp; Computation</b>            Chair: <b>Robert Fathauer</b>            Location: <b>Max Bell Room 159</b></p> <p>2:15–2:40 Art and Nonlinear            Projection  <i>John Brosz, Sheelagh Carpendale, Faramarz Samavati, Hao Wang and Alan Dunning</i></p> <p>2:50–3:15 A New Method for            Designing Iterated Knots  <i>Robert Fathauer</i></p>	<p>Workshops I            Coordinated by <b>Mara Alagic and Paul Gaiiunas</b>            Location: <b>Max Bell Room 252</b></p> <p>2:15–3:25 Perspectives on            Perspective  <i>Duncan Melville and Sarah Melville</i></p> <p>3:35–4:45 Transferring Patterns: From            Twill to Peyote Stitch  <i>Eva Knoll</i></p>
Break (4:00–4:30)		
<p>Regular Papers III: <b>Polyhedra</b>            Chair: <b>B.G. Thomas</b>            Location: <b>Max Bell Auditorium</b></p> <p>4:30–4:55 Using Polyhedral            Stellations for Creation of            Organic Geometric            Sculptures  <i>Vladimir Bulatov</i></p> <p>5:05–5:30 Polyhedra Through the            Beauty of Wood  <i>Robert Rollings</i></p> <p>5:40–6:05 Counterchange Patterns            and Polyhedra  <i>B.G. Thomas</i></p>	<p>Short Papers I            Chair: <b>Darrah Chavey</b>            Location: <b>Max Bell Room 159</b></p> <p>4:30–4:40 Text from Truchet Tiles  <i>David Reimann</i></p> <p>4:50–5:00 ZenArt, graphic            geometrical modules  <i>André Génard</i></p> <p>5:10–5:20 Amazing Labyrinths,            further developments  <i>Samuel Verbiese</i></p> <p>5:30–5:40 Mathematical Experiments            with African Sona Designs  <i>Darrah Chavey</i></p> <p>5:50–6:00 Geometric            Transformations in Surface            Design Generation  <i>Fatma Mete</i></p>	<p>4:55–6:05 Stories Count: Narrative            Approaches to            Quantitative Learning  <i>Suzie Garfield</i></p>

# Tuesday, July 28th: Full program

July 28th, Morning (9:00–12:00)	
Paper sessions and workshops <i>See next page for detailed morning schedule.</i>	
Lunch (12:00–1:30)	
July 28th, Afternoon (1:30–6:00)	
<b>Bridges Excursion</b>  An excursion by motorcoach to several regional sightseeing destinations. Tickets will be available on July 26th and cost \$20 per person. <b>The coaches will depart from The Banff Centre promptly at 1:30.</b>	
Dinner (6:00–7:30)	
July 28th, Evening (7:30–10:00)	
Evening Program	
7:30–8:00	<b>Wine (partially supported by Taylor &amp; Francis) and cash bar</b>
8:00–10:00	<b>Music Night</b> <i>Hosted by Vi Hart</i>

# Tuesday, July 28th: Paper sessions and workshops

July 28th, Morning (9:00–12:00)		
<p>Regular Papers I: <b>Geometry</b> Chair: <b>Paul Gaiiunas</b> Location: <b>Max Bell Auditorium</b></p> <p>9:00–9:25 Real Tornado <i>Akio Hizume and Yoshikazu Yamagishi</i></p> <p>9:35–10:00 Spidronised Space-Fillers <i>Walt van Ballegooijen, Paul Gaiiunas and Dániel Erdély</i></p> <p>10:10–10:35 Concave Hexagons <i>Paul Gaiiunas</i></p>	<p>Short Papers I Chair: <b>Stephen Luecking</b> Location: <b>Max Bell Room 159</b></p> <p>9:00–9:10 The Quinary —Permuting Meaning with Generative Poetry <i>Brian Evans</i></p> <p>9:20–9:30 This Equation is Art <i>Peter Smith</i></p> <p>9:40–9:50 The Frustrated Mathematician <i>Michael Frantz</i></p> <p>10:00–10:10 Mathematical Iconography in Gaudí's Cosmos <i>Stephen Luecking</i></p>	<p>Workshops I Coordinated by <b>Mara Alagic and Paul Gaiiunas</b> Location: <b>Max Bell Room 252</b></p> <p>9:00–10:10 Exploring Some of the Mathematical Properties of Chains <i>Eva Knoll and Tara Taylor</i></p> <p>10:20–11:30 Chaos, Complexity, and Creativity <i>Krystyna Laycraft</i></p>
Break (10:30–11:00)		
<p>Regular Papers II: <b>Teaching Mathematics</b> Chair: <b>Peter Hamburger</b> Location: <b>Max Bell Auditorium</b></p> <p>11:00–11:25 Comic Books That Teach Mathematics <i>Bruce Kessler</i></p> <p>11:35–12:00 Using Works of Visual Art to Teach Matrix Transformations <i>James Luke Akridge, Rachel Bowman, Peter Hamburger and Bruce Kessler</i></p>	<p>Regular Papers III: <b>Art from Groups</b> Chair: <b>Jay Zimmerman</b> Location: <b>Max Bell Room 159</b></p> <p>11:00–11:25 Regular 3D Polygonal Circuits of Constant Torsion <i>Tom Verhoeff and Koos Verhoeff</i></p> <p>11:35–12:00 A Group Portrait on a Surface of Genus Five <i>Jay Zimmerman</i></p>	



# Wednesday, July 29th: Full program

## July 29th, Morning (9:00–12:00)

Plenary Talks III  
Max Bell Auditorium  
Chair: **George Hart**

- 9:00–9:45      Plenary Talk: **Tubular Sculptures**  
*Carlo Séquin*
- 10:00–10:45    Plenary Talk: **Three Conceptions of Musical Distance**  
*Dmitri Tymoczko*
- 11:00–11:45    Plenary Talk: **Non-Flat Tilings with Flat Tiles**  
*Rinus Roelofs*

## Lunch (12:00–2:15)

## July 29th, Afternoon (2:15–6:05)

Paper sessions and workshops  
*See next page for detailed afternoon schedule.*

## Dinner (6:05–8:00)

## July 29th, Evening (8:00–10:00)

Evening Program

- 8:00–10:00      **Theatre night**  
*Hosted by Steve Abbott*

# Wednesday, July 29th: Paper sessions and workshops

July 29th, Afternoon (2:15–6:05)		
<p>Regular Papers I: <b>Algorithmic Images</b> Chair: <b>Gary Greenfield</b> Location: <b>Max Bell Auditorium</b></p> <p>2:15–2:40 Map-Colored Mosaics <i>Robert Bosch and Andrew Pike</i></p> <p>2:50–3:15 ShamsehTrees: Providing Hierarchical Context for Nodes of Interest <i>Katayoon Etemad and Sheelagh Carpendale</i></p> <p>3:25–3:50 Composite Digital Mosaics using Duotone Tiles <i>Gary Greenfield</i></p>	<p>Short Papers I Chair: <b>Billy C. Scannell</b> Location: <b>Max Bell Room 159</b></p> <p>2:15–2:25 Binary Based Fresco Restoration <i>Wolfgang Baatz, Massimo Fornasier, Peter A. Markowich and Carola-Bibiane Schönlieb</i></p> <p>2:35–2:45 A Myriad Shades of Green <i>Liselott Flodén, Anders Holmbom, Marianne Olsson and Jens Persson</i></p> <p>2:55–3:05 Talking About Math/Art: The Long Pause <i>Bathsheba Grossman</i></p> <p>3:15–3:25 An Optical Demonstration of Fractal Geometry <i>Billy C. Scannell, Ben Van Dusen and R.P. Taylor</i></p> <p>3:35–3:45 Realistic Image Making with Mandelbrot Set <i>Mehrdad Garousi and Khalil Taleslami</i></p>	<p>Workshops I Coordinated by <b>Mara Alagic and Paul Gailiunas</b> Location: <b>Max Bell Room 252</b></p> <p>2:15–3:25 Workshop on The Fusion Project: Bridging Art Museums and Middle School Math Teachers <i>Benjamin Wells and Philip Wagner</i></p> <p>3:35–4:45 Workshop: Working With Patterns To Introduce Mathematics Concepts To Young Children <i>Patricia Bentley</i></p>
Break (4:00-4:30)		
<p>Regular Papers II: <b>Counting &amp; Colouring</b> Chair: <b>Goran Konjevod</b> Location: <b>Max Bell Auditorium</b></p> <p>4:30–4:55 Combinatoria Poetica: Counting and Visualizing Rhyme Patterns in Sonnets <i>Hartmut F.W. Höft</i></p> <p>5:05–5:30 Coloring Uniform Honeycombs <i>Glenn Laigo, Ma. Louise Antonette N. De las Peñas and René Felix</i></p> <p>5:40–6:05 Notation for a Class of Paperfolded Models <i>Goran Konjevod and Ana Maria Kuprešanin</i></p>	<p>Short Papers II Chair: <b>Curtis Palmer</b> Location: <b>Max Bell Room 159</b></p> <p>4:30–4:40 Chaos – The Movie <i>Susan Happersett</i></p> <p>4:50–5:00 Plane, Space, Cubism and Perpetual Displacement in 3D Design <i>Joel Varland</i></p> <p>5:10–5:20 Finding a New Route to the Moon Using Paintings <i>Edward Belbruno</i></p> <p>5:30–5:40 Spelunking Adventure II: Combining Cyclons <i>Curtis Palmer</i></p>	<p>4:55–6:05 Creating Islamic Patterns from Folded Shapes <i>E.B. Meenan and B.G. Thomas</i></p>

# Thursday, July 30th: Full program

July 30th, Morning (9:00–12:00)

## **Banff Centre Exploration**

Visit several different facilities on the campus of The Banff Centre, meet the staff, and explore their many ongoing activities in music, dance, theatre, and art.