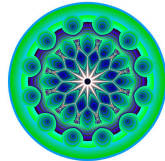


BYRNE SEMINAR, SPRING SEMESTER 2009
(One-Credit, 5 Lectures \times 160 Minutes)
Meeting day & time: Th 3:00-5:40 PM
Location: Hill 250 - Busch Campus

POLYNOMIOGRAPHY



THE FINE ART AND SCIENCE OF VISUALIZING POLYNOMIALS

Bahman Kalantari
Professor of Computer Science, Rutgers University
Email: kalantari@cs.rutgers.edu, Web: www.polynomiography.com

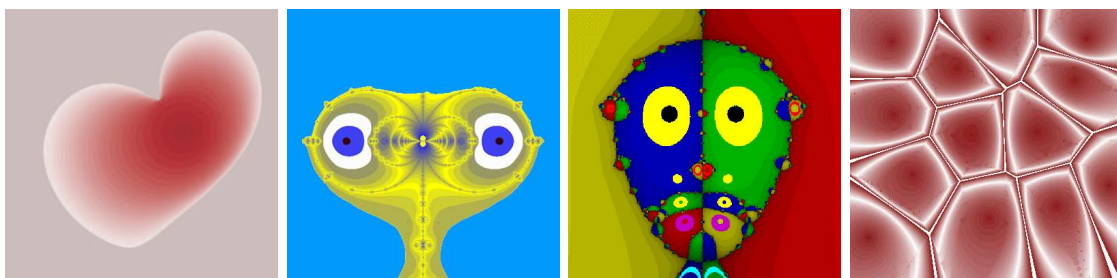
WARNING!!! It is proven you will like polynomials and polynomiography.

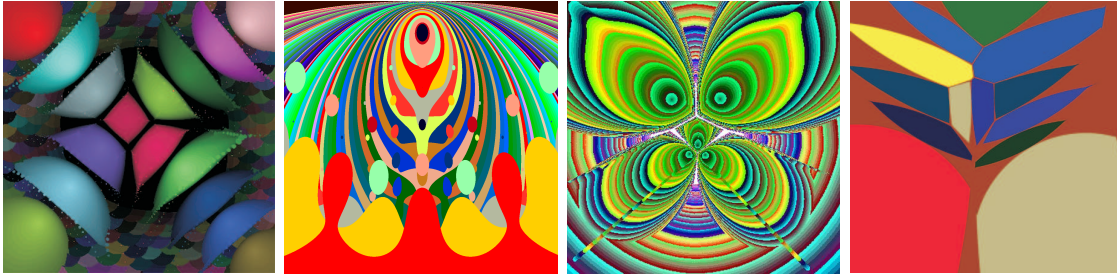
“Over the centuries, mathematicians have developed a variety of methods of solving equations ... Bahman Kalantari of Rutgers University has developed visualization software that brings the process of finding the roots of a polynomial equation into the realm of design and art.” Ivars Peterson, SCIENCE NEWS

“Lose your fear of math with computer graphics that displays the beauty and symmetry hidden within algebraic equations.” DISCOVER Magazine

“I really enjoyed this first year seminar. It was very interesting learning about polynomiography. This was a very different and refreshing approach to math. I would recommend other Rutgers students to take this course.” Anonymous 2008 Seminar Student

*“POLYNOMIOGRAPHY!!!!!!!!!!!!!!!!!!!!!!!!!!!!!! I LOVE IT!!!
It was so incredibly cool. I just want to take it home and play on it the rest of the summer!”* A Middle School Student at Girls Plus Math Camp in Illinois.





SEMINAR INFORMATION: This interdisciplinary seminar will introduce the student to the historic problem of solving a polynomial equation, but from a modern point of view and in connection with its computer visualization via techniques of *polynomiography*. Polynomiography brings polynomials into the realm of art and design. Students will get to appreciate the connections between the creative nature of art and the inner beauty of math based on algorithmic visualization of polynomial equations. They will be introduced to complex numbers, fractals, iteration functions, dynamical systems, and polynomiography, as well as its techniques and its many potentials in the visual arts. Students will also get the opportunity to experiment with an advanced demo polynomiography software, making their own *polynomiographs*. No computer programming is necessary.

You Don't Have To Be a Mathematician to Be a *Polynomiographer*.

SAMPLE READINGS: Motivational topics selected from the following list, as well as basic and introductory material from some of the instructor's related publications listed at the end. Ivars Peterson, The Colors of an Equation, Science News Online, 2003.

www.sciencenews.org/articles/20030419/mathtrek.asp

Ivars Peterson, Fragment s of Infinity, A Kaleidoscope of Math and Art, Wiley 2001.

Barry Mazur, Imagining Numbers:(particularly the square root of minus fifteen), Picador, 2003.

ASSIGNMENT: A short related paper, or a small project of artistic, mathematical, educational, or algorithmic nature (individually or in small groups). A project may include interaction with a demo polynomiography software to create artwork, animation, prints, etc.

FIELD WORK: Attending an exhibition, a museum visit, something interesting.

BRIEF BIOGRAPHY: Dr. Kalantari's major research areas include: mathematical programming, discrete and combinatorial optimization, theory of polynomial root-finding, and polynomiography - a term he has coined for techniques in visualization of a polynomial equation - a multidisciplinary U.S. patented technology with vast potential applications in art and design, science and education.

Dr. Kalantari's polynomiography has been praised by artists, scientists, mathematicians, educators, students, and the general public. His artwork has been exhibited nationally and internationally in such venues as an art-math exhibit that initiated at the Henri Poincaré Institute (Paris), traveling to other cities in France and Greece. Polynomiography artwork has been part of exhibitions in Gallery Art Park (Seoul) SIGGRAPH Art Gallery (LA), NKS confer-

ence (Boston), as well as the Art Library at Rutgers University, the Lawrenceville School Art Gallery, and around New Jersey. Notable mention in New Jersey media include the Star-Ledger, New Jersey Savvy Living Magazine; notable mention in international media include the Science News, DISCOVER Magazine, Tiede (popular science magazine of Finland), Muy Interstante (popular science magazine of Spain). Dr. Kalantari's artwork has appeared on the cover of several publications such as Rutgers Graduate Catalog, Computer Graphics Quarterly, Princeton University Press Mathematics Catalog, and Tiede. Other accolades may be found at www.polynomiography.com.

Dr. Kalantari has published extensively and in a wide range of journals such as, Journal of The Association for Computing Machinery, Algorithmica, Contemporary Mathematics, SIAM Journal on Optimization, SIAM Journal on Matrix Analysis, Mathematical Programming, Linear Algebra and its Application, Mathematics of Computation, Advances in Applied Mathematics, Computers & Graphics, Numerical Algorithms, Journal of the Operations Research, Computer Graphics Quarterly, Mathematics of Operations Research, Discrete Applied Mathematics, Journal of Computational and Applied Mathematics, Information Processing Letters, Operations Research Letters, LEONARDO, Mathematics & Design, Visual Mathematics, DIMACS Series, Proceedings of ISAMA (The International Society of the Arts Mathematics and Architecture), Proceedings of BRIDGES (Mathematical Connections in Art Music and Science), Proceedings of SIGGRAPH (Special Interest Group on Computer Graphics).

Dr. Kalantari has taught more than a dozen distinct undergraduate and graduate course at Rutgers computer science department, including design and analysis of algorithms, discrete structures, numerical analysis, linear programming, and polynomiography.

Dr. Kalantari has given numerous polynomiography presentations at middle and high schools, universities, and conferences in: New Jersey, Arizona, Boston, Los Angeles, San Diego, Baltimore, New York City, Illinois, Puerto Rico, Italy, France, Belgium, Germany, Argentina, Brazil, Spain, Canada, and Austria.

His present activities on polynomiography include developing polynomiography software for artistic and educational use, attending educational conferences in New Jersey and beyond. At the artistic level he intends to continue creating 2D and even 3D artwork, and to participate in exhibitions. He plans to extend polynomiography in collaboration with various experts. In particular, in Spring 2009 he plans to organize a DIMACS Workshop on "Algorithmic Mathematical Art and Its Applications."

SAMPLE RELATED PUBLICATIONS:

- B. Kalantari, A new medium for visual art: Polynomiography, Computer Graphics Quarterly, 38 (2004), 22-24.
- B. Kalantari, Polynomiography and application in art, education, and science, Computers & Graphics, 28 (2004), 417-430.
- B. Kalantari, Polynomiography: From the Fundamental Theorem of Algebra to Art, LEONARDO, 38 (2005), 233-238.
- B. Kalantari, Polynomiography in art and design, Mathematics & Design, 4 (2004), 305-311.
- B. Kalantari, Two and three-dimensional art inspired by polynomiography, Proceedings of BRIDGES, Banff, Canada, (2005), 321-328. Also in Visual Mathematics, Vol. 8, No. 1, 2006.
- B. Kalantari, I. Kalantari, F. Andreev, Animation of mathematical concepts using polynomiography, Proceedings of SIGGRAPH 2004 on Education.
- B. Kalantari, Polynomial Root-Finding and Polynomiography. World Scientific, forthcoming book, 2009. www.polynomiography.com