



## **Jacek Turski**

Computer and Mathematical Sciences  
University of Houston-Downtown  
One Main Street  
Houston, Texas 77002  
Office: (713) 221-8401  
Home: (713) 349-9934  
Email: [turskij@uhd.edu](mailto:turskij@uhd.edu)  
Webpage: <http://cms.dt.uh.edu/Faculty/TurskiJ/>

### **EDUCATION**

Ph.D. (1986) **MCGILL UNIVERSITY**, Montreal, Canada  
Departments of Mathematics and Mechanical Engineering

M.Sc. (1976) **UNIVERSITY OF WARSAW**, Warsaw, Poland  
Department of Physics

### **RESEARCH**

Geometric Fourier analysis of the group  $SL(2, C)$ —the projective Fourier analysis of the conformal camera with the group  $SL(2, C)$  generating image projective transformations—has been constructed in the framework of representation theory of semisimple Lie groups. It provides the data model for efficient perspectively covariant digital image representation well adapted to the retino–cortical mapping of the human vision system, and therefore, explicitly designed for the foveated sensors of a silicon retina.

The ongoing research develops a design based on projective Fourier analysis which computationally integrates the head, the eyes (the conformal cameras) and the visual cortex. This system outputs mimic the 2D cortical images for which the brain’s disparity-tuned neurons use simple geometry of the fact that the scene is “seen” from different vantage points by each eye, to estimate the relative depth of objects in the 3D world.

The future work will further integrate this system as a computational unit capable of simulating qualitative experiments with the tasks of depth perception and movements of eyes.

## EMPLOYMENT

- 1990-present **UNIVERSITY OF HOUSTON-DOWNTOWN**, Department of Computer and Mathematical Sciences, Professor since September 2004
- 1989-1990 **UNIVERSITY OF HOUSTON**, Department of Mathematics, Postdoctoral Fellow
- 1988-1989 **UNIVERSITY OF HOUSTON**, Department of Mechanical Engineering, Visiting Scholar
- 1987-1988 **UNIVERSITY OF MANITOBA**, Department of Applied Mathematics, Research Associate
- 1986-1987 **UNIVERSITY OF MANITOBA**, Department of Civil Engineering, Research Associate

## TEACHING

I have taught a wide selection of undergraduate courses, including Calculus sequence, Differential Equations, Stochastic Processes, Non-Euclidean Geometry, Abstract Algebra, Real Analysis and Advanced Mathematics for Engineering. Most courses included the projects designed to enhance the course fundamental concepts.

## SELECTED PAPERS

1. J. Turski, Computational Harmonic Analysis for Human and Robotic Vision Systems, *Neurocomputing*, **69**, 1277-1280, 2006.
2. J. Turski, Geometric Fourier Analysis for Computational Vision, *Journal of Fourier Analysis and Applications*, **11**, 1-23, 2005.
3. J. Turski, Geometric Fourier Analysis of the Conformal Camera for Active Vision, *SIAM Review*, **46**, 230-255, 2004.
4. J. Turski, Projective Fourier Analysis for Patterns, *Pattern Recognition*, **33**, 2033-2043, 2000.
5. J. Turski, Harmonic Analysis on  $SL(2, C)$  and Projectively Adapted Pattern Representation, *Journal of Fourier Analysis and Applications*, **4**, 67-91, 1998.
6. J. Turski, Projective Fourier Analysis in Computer Vision: Theory and Computer Simulations, in the *SPIE Proceedings on Vision Geometry VI*, **3168**, 124-135, 1997.

7. E. Barany, M. Golubitsky and J. Turski, Bifurcations with Local Gauge Symmetries in the Ginzburg-Landau Equations, *Physica D*, **56**, 35-56, 1992.
8. J. Turski, A principal fiber bundle formulation of the dynamics of pseudo-rigid bodies, *Continuum Mechanics and Its Applications*, (Eds. Graham, G.A. and Malik, S.K.), 915-926, 1988.
9. J. Turski, Variation Principles in Continuum Mechanics and their Applications in the Study of Propagating Discontinuities, *Developments in Geomathematics*, **5**, 235-246, 1986.

## PRESENTATIONS AT PROFESSIONAL MEETINGS

1. J. Turski, Geometric Fourier Analysis for Cognitive Visual Neuroscience, *Joint Mathematics Meetings*, H.B. Convention Center, San Antonio, Texas, January 12-15, 2006.
2. J. Turski, Computational Harmonic Analysis for Physiologically Realistic Binocular Vision, *GCC for Theoretical Computational Neuroscience: the 3<sup>rd</sup> Annual Conference*, Rice University, Houston, Texas, November 2, 2005.
3. J. Turski, Computational Harmonic Analysis for Human and Robotic Vision Systems, at the *14<sup>th</sup> Annual Computational Neuroscience Conference*, Madison, Wisconsin, July 17-21, 2005.
4. J. Turski, Harmonic Analysis on  $SL(2, C)$  with Applications in Cognitive Vision Systems, at the *Special Semester: Modern Methods of Time-Frequency Analysis*, The Erwin Schrödinger International Institute for Mathematical Physics, Vienna, Austria, June 27-July 8, 2005.
5. J. Turski, Geometric Fourier Analysis for Computational Vision: Biological and Mathematical Background, at the *9<sup>th</sup> International Conference on Cognitive and Neural Systems*, Boston University, Boston, Massachusetts, May 18-21, 2005.
6. J. Turski, Projective Fourier Analysis in Computer Vision: Mathematics for Silicon Retina Sensors of Active Vision, at the *SIAM Conference on Mathematics for Industry: Challenges and Frontiers*, Toronto, Ontario, October 13-15, 2003.
7. J. Turski, Image Processing and Analysis for the Silicon Retina Sensors, at the *University of Houston Scholarship and Community Conference XI: Bringing Science to Life: A Conversation with Oliver Sacks and Others*, Houston, Texas, October 1, 2003.

8. J. Turski, Projective Harmonic Analysis and Digital Image Processing, at the *International Conference of Computational Harmonic Analysis*, Hong Kong, June 4-8, 2001.
9. J. Turski, Projective Harmonic Analysis and Rendering Projective Distortions of Patterns, Presented at the *4th International Conference Curves and Surfaces*, Saint-Malo, France, July 1-7, 1999.
10. J. Turski, Projective Harmonic Analysis in Computer Vision: A complete theory, at the *5th SIAM Conference on Geometric Design 97*, Nashville, Tennessee, November 3 - 6, 1997.
11. J. Turski, Projectively Adapted Pattern Representation using Noncommutative Harmonic Analysis, at the *IS&P/SPIE Symposium on Electronic Imaging: Science and Technology*, San Jose, CA, January 28 - February 2, 1996.
12. J. Turski, On a Three-dimensional Extension of Bifurcation Analysis with Local Gauge Symmetries for the Ginzburg-Landau Equations, at the *AMS-IMS-SIAM Summer Research Conference on Mathematics of Superconductivity*, Seattle, July 25-29, 1993.
13. J. Turski, Bifurcations with Local Gauge Symmetries: Patterns in Superconductors, at the *SIAM Conference on Applications of Dynamical Systems, Snowbird, Utah, October 1992*.  
[Jointly with M. Golubitsky and E. Barany]

## EXTERNAL GRANTS

1. **NSF Research Grant:** *Computing Projective Fourier Transforms and Rendering Projective Distortions of Patterns*, Computer and Mathematical Sciences, UH-D, 1999-2002.
2. **NSF Research Opportunity Award:** *The Ginzburg-Landau system of coupled cells with local gauge symmetries*, Department of Mathematics, UH, 1995.  
[Jointly with M. Golubitsky]

## AWARDS

1. **Faculty Award for Excellence in Scholarship and Creativity**, University of Houston-Downtown, 2006.
2. **J.W. McConnell Fellowship**, Department of Mathematics, McGill University, 1981-1982.