

# MIHAIL N. KOLOUNTZAKIS

*Professor*

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(where all publications can be found online)

October 2008

## PERSONAL

Born on 30 May 1966 in Iraklio (Heraklion), Greece. Married to Maria Loukaki. One son (Nikos) and one daughter (Ioanna).

## CURRENT POSITION

- Professor, Dept. of Mathematics, Univ. of Crete, Greece.

## EDUCATION–EMPLOYMENT

8/2006 - present	Univ. of Crete	Professor
1/2007 - 5/2007	Georgia Inst. of Technology	Visting Professor
6/2000 - 7/2006	Univ. of Crete	Associate Professor
8/2004 - 5/2005	Georgia Inst. of Technology	Visting Associate Professor
10/1999 - 5/2000	Univ. of Crete	Visiting Associate Professor
12/1998 - 10/1999	Hellenic Air Force	Military service
Fall 1998-99	Univ. of Illinois at Urbana-Champaign	Visiting Assistant Professor
1997-1998	Univ. of Crete	Visiting Assistant Professor
1996-1997	Univ. of Illinois at Urbana-Champaign	Visiting Assistant Professor
1994-1996	School of Math., Inst. for Advanced Study, Princeton NJ	Member
1989-1994	Stanford Univ.	Ph.D. in Math. (advisor P.J. Cohen)
1989-1991	Stanford Univ.	MSc in Mathematics
1988-1989	Univ. of Crete	Graduate student in the Math. Dept.
1984-1988	Univ. of Crete	B.Sc. in Computer Science

## MATHEMATICAL INTERESTS

### 1. Harmonic Analysis and its Applications

Applications of harmonic analysis to geometric and number-theoretic problems • Extremal problems concerning trigonometric polynomials and positive definite functions

### 2. Additive Number Theory

Density of  $B_h[g]$  sets and of additive bases • Sum-free sets • Additive complements • Effective algorithms in Number Theory.

### 3. Applications of Probability Theory

Mostly to Harmonic Analysis and Number Theory • Turning probabilistic (existential) arguments into efficient algorithms.

#### 4. Theoretical Computer Science

**PhD Thesis** (June 1994; advisor P.J. Cohen)

PROBABILISTIC AND CONSTRUCTIVE METHODS IN HARMONIC ANALYSIS AND ADDITIVE NUMBER THEORY.

## TEACHING EXPERIENCE

### University of Crete:

5 semesters (2 hrs/week recitation sessions + office hours). Calculus and Linear Algebra.  
1 semester Multivariable Calculus for the Dept of Materials Science  
2 semesters Complex Analysis  
3 semesters Discrete Mathematics  
4 semesters The Problem Seminar  
1 semester Group Theory  
1 semester Measure Theory (graduate)  
1 semester Introduction to Computing  
2 semesters Probability Theory  
3 semesters Graduate Probability Theory  
2 semesters Formal Languages and Introduction to Computability  
2 semesters Stochastic Processes (graduate)  
1 semester Randomized Algorithms (graduate)  
1 semester Stochastic Processes (undergraduate)

### Stanford University:

5 quarters (4 hrs/week in class + office hours). Calculus.

### Univ. of Illinois:

2 semesters of Linear Algebra (MATH 315—for 3rd and 4th year students),  
1 semester of Combinatorial Mathematics (MATH/CS 313—3rd year students to beginning graduate students),  
1 semester of Multivariable Calculus,  
1 semester of Introduction to Real Analysis.

### Georgia Inst. of Technology:

2 semesters of Multivariable Calculus.

## STUDENTS

**Panagiotis Mavroudis**, PhD student since Spring 2007-08.

**Ioannis Konstantoulas**, diploma thesis on **Random matrices: determinant and invertibility**. (Spring 2007-08)

**Costas Rabalakos**, Master's thesis on **Quantum Computation**. (Spring 2003-04).

**Maria Reppa**, diploma thesis on **Network flow**. (Spring 2003-04).

## TALKS/CONFERENCES:

I have spoken (or presently will speak) at the following conferences/workshops:

1. Workshop on Emerging Applications of Probability, IMA, Minneapolis, MN, September 1993 (contributed talk).
2. Special Session on Harmonic Analysis, 886th AMS meeting, College Station, TX, October 1993 (invited).
3. Symposium On Discrete Algorithms (SODA), Washington DC, January 1994 (refereed conference).
4. Workshop in Additive and Combinatorial Number Theory, CUNY, March 1995 (invited).
5. Int. Conf. Analytic Number Theory, Univ. Illinois Urbana-Champaign, May 1995 (invited).
6. Harmonic Analysis from the Pichorides Viewpoint, Univ. of Crete, Greece, July 1995 (invited).
7. DIMACS workshop on Combinatorial Number Theory, February 1996 (invited).
8. Illinois Number Theory Conference, April 1997 (one of four invited lectures).

9. Workshop on the interface of Probability and Number Theory, May 2000, Univ. of Illinois (invited).
10. Workshop on Applied Mathematics, July 2000, Univ. of Crete, Greece.
11. Euroconference on Discrete and Algorithmic Geometry, August 2000, Anogia, Crete, Greece.
12. Hellenic conference on Mathematical Analysis, October 2000, Xanthi, Greece.
13. Rajchman-Zygmund-Marcinkiewicz Symposium, October 2000, Bedlewo, Poland.
14. Second Göteborg Conference in Harmonic Analysis and Partial Differential Equations, Göteborg, Sweden, June 2001.
15. Workshop on Fourier Analysis and Convexity (invited mini-course), June 2001, University of Milano-Bicocca.
16. Workshop on Periodicity and Quasi-periodicity, June 2002, Renyi Institute, Budapest (invited).
17. Combinatorial and Number-Theoretic Methods in Harmonic Analysis, Spring 2003, Erwin Schrödinger Institute, Vienna (invited).
18. Théorie des Nombres et Probabilités, November 2003, CIRM, Marseille (invited).
19. Special program in Harmonic Analysis, April-July 2004, Centro de Giorgi, Pisa (invited).
20. 7th International Conference on Harmonic Analysis and Partial Differential Equations, El Escorial, Madrid (Spain), June 21-25, 2004 (invited).
21. Workshop in Real Analysis, Harmonic Analysis and Applications to PDE, Oberwolfach, Germany, July 3-9, 2005 (invited).
22. 3rd Meeting for Young Researchers in Analysis, Karlovasi, Samos, Greece, September 16-18, 2005 (invited).
23. Interface entre l'analyse harmonique et la theorie des nombres, 17-21 October, 2005, CIRM, Marseille (invited).
24. Complex and Harmonic Analysis: an international conference, Thessaloniki, Greece, May 25 - 27, 2006 (invited).
25. Analysis, Number Theory and Logic: Honoring Paul Cohen on his 72nd birthday, Stanford University, September 14-17, 2006 (invited).
26. Illinois Number Theory Fest, Univ. of Illinois at Urbana-Champaign, May 16-20, 2007.
27. Second Workshop on Extremal Problems in Fourier Analysis, Renyi Institute, Budapest, 18-23 September 2007 (invited).
28. Problems in Analysis 2007, Iraklio, Crete, Greece, October 5-7, 2007 (organizer).
29. Analytical and Combinatorial Methods in Number Theory and Geometry 2007, Iraklio, Crete, Greece, October 22-26, 2007 (organizer).
30. Clay-Fields Conference on Additive Combinatorics, Number Theory, and Harmonic Analysis, Fields Institute, Toronto, April 5-13, 2008 (invited).
31. 12th Panhellenic Conference in Mathematical Analysis, Univ. of Athens, May 15-17, 2008 (plenary talk).
32. Problems in Analysis 2008, Samos, Greece, September 26-29, 2008.
33. Workshop on Fractals and Tilings 2009, July 6 - 10, 2009, Strobl, Austria (invited).

I have given talks at the following departments:

1. Aristotle University of Thessaloniki, Greece

2. Caltech, USA
3. Cornell Univ., USA
4. CUNY, New York Number Theory Seminar, USA
5. Erwin Schrödinger Institute, Austria
6. Georgetown Univ., USA
7. Georgia Institute of Technology, USA
8. IBM Almaden Research Center, Computer Science, Theory Group, USA
9. Lehigh Univ., USA
10. National Technical Univ. of Athens, Greece
11. Oklahoma State Univ., USA
12. Renyi Institute, Hungary
13. Princeton University, USA
14. Scuola Normale Superiore, Pisa, Italy
15. Stanford Univ., USA
16. Texas A&M Univ., USA
17. Univ. of Athens, Greece
18. Univ. of the Aegean, Greece
19. Univ. of Crete, Greece
20. Univ. of Georgia, Athens, GA, USA
21. Univ. of Illinois U–C, USA
22. Univ. Illinois at Chicago, USA
23. Univ. di Milano–Bicocca, Italy
24. Univ. Missouri, Columbia, USA
25. Univ. of Texas at Austin, USA
26. Univ. of Toronto, Canada
27. Univ. California Riverside, USA
28. Univ. Maryland College Park, USA
29. Univ. of Wisconsin–Madison, USA

## **ORGANIZED MEETINGS:**

I have co-organized the following meetings:

1. *Analytical and Combinatorial Methods in Number Theory and Geometry 2007*, Crete, October 2007.
2. *Problems in Analysis 2007*, Crete, October 2007.
3. *Harmonic Analysis and Related Problems 2006 – HARP 2006*, Crete, June 2006.
4. *Two day meeting “Complex and Harmonic Analysis”*, Crete, May 2002.
5. *Two days of talks in Analysis for young researchers*, Crete, September 2001.
6. *Two days of talks in analysis*, Crete, June 2000.

## **ORGANIZED SEMESTER-LONG SEMINARS:**

I have organized (alone or with others) the following semester-long seminars:

1. *Percolation and Disordered Systems*, Crete, Spring 99-00.
2. *Fourier Analysis Seminar*, Crete, Spring 00-01.
3. *Results in Theoretical Computer Science*, Crete, Spring 01-02.

## **LONG-TERM VISITS:**

1. Caltech (May-June 1997, November 1998)
2. Renyi Institute (June 2002, July 2003)
3. Univ. di Milano-Bicocca (June 2001, October 2002)
4. Georgia Inst. of Technology (August 2004–May 2005)

## **RESEARCH GRANTS:**

1. Univ. of Crete (2007), Applications of Fourier Analysis to problems of discrete geometry.
2. INTAS 03-51-5070 (2004), Analytical and Combinatorial Methods in Number Theory and Geometry.
3. European Union Research Training Network HARP (Harmonic Analysis and Related Problems). July 2002 - July 2006.
4. INTAS Call 99 OPEN-1080 (Function spaces and harmonic analysis). June 2000-June 2002
5. National Science Foundation (USA) DMS 97-05775 (A Harmonic Analysis approach to problems of tiling). May 1997-December 1998

**REVIEWER** for the Mathematical Reviews and the Zentralblatt für die Mathematik.

**REFEREE** for the following journals:

1. Acta Arith.
2. Amer. J. Math.
3. Computer J.
4. Electr. J. Comb.
5. Eur. J. Comb.
6. Geometric and Functional Analysis
7. Graphs and Combinatorics
8. IEEE Trans. Pattern Anal. Mach. Intel..
9. IMRN
10. Intern. J. Number Theory
11. Inf. Proc. Letters
12. J. AMS
13. J. Fourier Anal. Appl.
14. Bulletin/Proceedings/Journal of the London Math. Society
15. J. Math. Anal. Appl.
16. J. Number Th.
17. Math. Res. Letters
18. Math. Zeitschrift
19. Online J. Analytic Combinatorics
20. Proc. AMS
21. Real Analysis Exchange
22. Studia Math.
23. Theoretical Computer Science
24. Trans. AMS

## **OTHER WORKING EXPERIENCE**

1. **(1997-2002)** System administration for many Unix systems of the Department of Mathematics, U. of Crete.
2. **(December 1991)** Worked for Failure Analysis Associates of Menlo Park, CA. Developed user interface for a program that computes the motion of a fluid under the surface of the earth.
3. **(Summer 1991)** Research Assistant, Center for Integrated Systems, Stanford University (Prof. M. Lam). Worked on parallel programming language JADE. Developed a parallel Finite Element code.
4. **(1990-92)** Center for Integrated Facility Engineering (CIFE), Stanford University (Prof. R. Levitt). Developed CIFECAD, a system for the design of structures in 3D using predefined elements. Developed educational software for Civil Eng. class on estimation.

5. (1986-89) and (1997–present) Horodomi, Iraklion, Greece.  
Development of of Finite Element code for static analysis of 3D structures.
6. (1986-88) Image Analysis Laboratory, Department of Comp. Sci., University of Crete.  
Mostly parallelization of algorithms for Image Processing. (See two earliest publications.)

## **OTHER SKILLS**

- A very competent computer programmer and an amateur system administrator (Unix).
- Fair knowledge of French and German (besides Greek and English).



## Submitted for publication

1. Alex Iosevich and M.N.K.,  
The discrepancy of a needle on a checkerboard, II, **submitted**
2. M.N.K. and Maté Matolcsi,  
Algorithms for translational tiling, **submitted**.

## Accepted for publication

1. M.N.K., Richard Lipton, Vangelis Markakis, Aranyak Mehta and Nisheeth Vishnoi,  
On the Fourier spectrum of symmetric boolean functions, *Combinatorica*, **to appear**.
2. M.N.K., E. Markakis and A. Mehta, Learning symmetric  $k$ -juntas in time  $n^{o(k)}$ ,  
Proceedings of the conference *Interface entre l'analyse harmonique et la theorie des nombres*, CIRM, Luminy, October 2005, **to appear**

## Published

1. M.N.K., The discrepancy of a needle on a checkerboard, *Online J. Analytic Combinatorics*, **3** (2008), #7.
2. Alex Iosevich, M.N.K. and Maté Matolcsi, *Covering the plane by rotations of a lattice arrangement of disks*, "Complex and Harmonic Analysis", Proceedings of the International Conference May 25-27, 2006, Aristotle University of Thessaloniki. Destech Publications, Inc.
3. A. Iosevich and M.N.K., A Weyl type formula for Fourier spectra and frames, *Proc. AMS* **134** (2006), 11, 3267–3274.
4. M.N.K. and M. Matolcsi, Tiles with no spectra, *Forum Math.* **18** (2006), 3, 519–528.
5. M.N.K. and Sz.Gy. Revész, Turán's extremal problem for positive definite functions on groups, *J. London Math. Soc.* (2) **74** (2006), 2, 475–496.
6. M.N.K. and Sz.Gy. Revész, On pointwise estimates of positive definite functions with given support, *Canadian J. Math.* **58** (2006), 2, 401–418.
7. Tamás Keleti and M.N.K., On the determination of sets by their triple correlation in finite cyclic groups, *Online J. Anal. Combinatorics*, **1** (2006), #4.
8. M.N.K. and M. Matolcsi, Complex Hadamard matrices and the Spectral Set Conjecture, *Collectanea Mathematica*, Vol Extra (2006), 281-291.
9. M.N.K., Filling a box with translates of two bricks, *Electr. J. Combin.*, **11** (2004), N16.
10. M.N.K., The study of translational tiling with Fourier Analysis. *Fourier Analysis and Convexity*, 131–187, Appl. Numer. Harmon. Anal., Birkhäuser Boston, Boston, MA, 2004.
11. M.N.K., Distance sets corresponding to convex bodies. *Geom. and Funct. Anal.*, **14** (2004), 4, 734-744.
12. M.N.K. and I. Łaba, Tiling and spectral properties of near-cubic domains. *Studia Math.*, **160**(2004), 287-299.
13. P. Jaming and M.N.K., Reconstruction of functions from their triple-correlations. *New York J. Math.* **9** (2003), 149-164.

14. M.N.K. and Sz.Gy. Revész, On a problem of Turán about positive definite functions,  
Proc. AMS **131** (2003), 3423-3430.
15. M.N.K. and M. Papadimitrakis, A class of non-convex polytopes that admit no orthonormal basis of exponentials,  
Illinois J. Math. **46** (2002), 4, 1227-1232.
16. M.N.K., Translational tilings of the integers with long periods  
Electr. J. Combinatorics **10** (2003), 1, R22.
17. M.N.K. and M. Papadimitrakis, The Steinhaus tiling problem and the range of certain quadratic forms,  
Illinois J. Math. **46** (2002), 3, 947-951.
18. M.N.K., Packing, tiling, orthogonality and completeness,  
Bull. London Math. Soc. **32** (2000), 5, 589-599.
19. M.N.K., Non-symmetric convex domains have no basis of exponentials,  
Illinois J. Math. **44** (2000), 3, 542-550.
20. M.N.K., On the structure of multiple translational tilings by polygonal regions,  
Discr. Comp. Geom. **23** (2000), 4, 537-553.
21. M.N.K., On the uniform distribution in residue classes of dense sets of integers with distinct sums,  
J. Number Th. **76** (1999), 147-153.
22. M.N.K. and Th. Wolff, On the Steinhaus tiling problem,  
Mathematika, **46** (1999), 2, 253-280.
23. M.N.K., Lattice tilings by cubes: whole, notched and extended,  
Electr. J. Combinatorics **5** (1998), 1, R14.
24. L.E. Kavradi, M.N.K and J.-C. Latombe, Analysis of Probabilistic Roadmaps for Path Planning,  
IEEE Transactions on Robotics and Automation **14** (1998), 1, 166-171. Also in Proc. IEEE Conf. Robotics and Automation, Minneapolis, 1996, 3020-3025.
25. M.N.K., Multi-lattice tiles,  
Intern. Math. Research Notices, 1997, 19, 937-952.
26. M.N.K., Lattice-tiling properties of integral self-affine functions,  
Appl. Math. Letters, **10** (1997), 5, 1-4.
27. M.N.K., Infinite Patterns That Can Be Avoided by Measure,  
Bull. London Math. Soc. **29** (1997), 4, 415-424.
28. (*Survey*) M.N.K., Some Applications of Probability to Additive Number Theory and Harmonic Analysis,  
in Number Theory: New York Seminar 1991-1995, Springer Verlag (1996).
29. M.N.K., On the Additive Complements of the Primes and Sets of Similar Growth,  
Acta Arith., **77** (1996), 1, 1-8.
30. M.N.K., A New Estimate for a Problem of Steinhaus,  
Intern. Math. Res. Notices, 1996, 11, 547-555.
31. M.N.K., A Problem of Steinhaus: Can All Placements of a Planar Set Contain Exactly One Lattice Point?  
Analytic Number Theory: Proceedings of a conference in honor of H. Halberstam, Birkhäuser, 1996.
32. M.N.K. and J.C. Lagarias, Tilings of the Line by Translates of a Function,  
Duke Math. J. **82** (1996), 3, 653-678.
33. M.N.K., The Density of  $B_n[g]$  Sets and the Minimum of Dense Cosine Sums,  
J. Number Theory **56** (1996), 1, 4-11.

34. N. Alon and M.N.K., On a Problem of Erdős and Turán and Some Related Results, J. Number Theory **55** (1995), 1, 82-93.
35. L.E. Kavradi and M.N.K., Partitioning a Planar Assembly Into Two Connected Parts is NP-Complete, Inf. Proc. Letters **55** (1995), 159-165.
36. M.N.K., Selection of a Large Sum-Free Subset in Polynomial Time, Inf. Proc. Letters **49** (1994), 255-256.
37. M.N.K., An Effective Additive Basis for the Integers <sup>1</sup>, Discr. Math. **145** (1995), 307-313. Also in Proc. Symposium On Discrete Algorithms (SODA) 1994.
38. M.N.K., A Construction Related to the Cosine Problem, Proc. Amer. Math. Soc. **122** (1994), vol. 4, 1115-1119.
39. M.N.K., On Nonnegative Cosine Polynomials with Nonnegative, Integral Coefficients, Proc. Amer. Math. Soc. **120** (1994), vol. 1, 157-163.
40. M.N.K. and K.N. Kutulakos, Fast Computation of the Euclidean Distance Map for Binary Images, Inf. Proc. Letters **43** (1992), 181-184.

### Technical Report

1. M.N.K. and S.C. Orphanoudakis, Computing Line Sums on a Mesh Connected Computer, Technical Report, Institute of Computer Science, Foundation of Research and Technology, Hellas, Greece, 1988.

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<sup>1</sup>This won a \$100 prize which was offered for the solution of this problem by Paul Erdős several years ago.