

Fall 2007  
University of Michigan-Department of Mathematics  
<http://www.math.lsa.umich.edu/seminars/index.shtml>  
Ann Arbor, MI 48109-1043  
**October 15th – October 21st**

**Monday, October 15**

- 3:10-4:00pm **Student Analysis Seminar** --- Not meeting this week --- 3866 EH  
3:10-4:00pm **Topics in Algebraic Geometry Seminar** --- Not meeting this week --- 2866 EH  
3:10-5:00pm **Number Theory and Representation Theory Seminar** --- Not meeting this week --- 4096 EH  
4:10-5:00pm **Several Complex Variables Seminar** --- Not meeting this week --- 3096 EH  
4:10-6:00pm **Geometry & Physics** --- Not meeting this week --- 4088 EH  
5:00-6:30pm **Teaching Mathematics** --- Not meeting this week --- 3088 EH

**Tuesday, October 16**

- 2:10-3:00pm **"What is ... " Seminar** --- Selim Esedoglu (UM) *What is ... the Mumford-Shah functional?* --- 3096 EH  
3:10-4:00pm **Geometry Seminar** --- Not meeting this week --- 4088 EH  
3:10-4:00pm **Algebra Seminar** --- Not meeting this week --- 3096 EH  
3:10-4:00pm **Algebraic Geometry Seminar (Special Lectures on Branchvarieties)** --- Allen Knutson (UCSD) *Schubert varieties in G/B are normal and Cohen-Macaulay* --- 3088 EH  
3:10-4:00pm **Student Representation Theory/Lie Theory Seminar** --- Not meeting this week --- 4096 EH  
4:10-5:00pm **Colloquium** --- Not meeting this week --- 1360 EH

**Wednesday, October 17**

- 3:10-4:00pm **Student Arithmetic Seminar** --- Wansu Kim (UM) TBA --- 3866 EH  
3:10-4:00pm **Student AIM Seminar (Special Seminar)** --- Ice Cream Social --- 3096 EH  
3:10-4:00pm **Working Group in Integrable Systems and Asymptotics** --- Peter Miller (UM) *Orthogonal polynomials in the complex plane, dbar problems, and random normal matrices* --- 4088 EH  
3:10-4:00pm **Geometric Function Theory Seminar** --- Steffen Rohde (U of Washington) *Random Quasiconformal Maps* --- 4096 EH  
4:10-5:30pm **Working Seminar in Several Complex Variables and Complex Dynamics** --- Andrei Iordan (Institut de Mathematiques de Jussieu) *Complex tangential curves of constant curvature in the unit ball of  $\mathbb{C}^2$  and homogeneous polynomials* --- 4088 EH  
4:10-6:00pm **Algebraic Geometry Seminar** --- Claude Sabbah (Ecole Polytechnique) *An extension of Hodge theory* --- 3088 EH

**Thursday, October 18**

- 12:10-1:00pm **Mathematical Biology Seminar** --- Daniel Forger (UM) TBA --- 4096 EH  
2:10-3:00pm **Student Algebraic Geometry Seminar** --- Wansu Kim (UM) *An Overview of Deligne-Illusie 2* --- 3866 EH  
2:10-3:00pm **Study Seminar (Pt. 1)** --- Pekka Pankka (UM) *The mapping class group V* --- 3096 EH  
3:10-4:00pm **Study Seminar (Pt. 2)** --- Pekka Pankka (UM) *The mapping class group V (cont.)* --- 4088 EH  
3:10-4:00pm **Financial/Actuarial Mathematics Seminar** --- Not meeting this week --- 3088 EH  
3:10-4:00pm **Commutative Algebra Seminar** --- Mel Hochster (UM) *Tor, Ext, and local cohomology ... continued* --- 3096 EH  
3:10-4:00pm **Topology Seminar** --- Xiaojun Chen (UM) *A chain model of the free loop space and string topology* --- 4096 EH  
4:10-5:00pm **Differential Equations** --- TBA --- 4088 EH  
4:10-5:00pm **Math Club** --- Jeff Lagarias (UM) *The  $3x+1$  Problem* --- 2<sup>nd</sup> Floor Nesbitt Room

**Thursday, October 18 .... continued**

4:10-5:00pm **Student Combinatorics** --- Dave Anderson (UM) *Tropical Geometry II* --- 3866 EH

**Friday, October 19**

10:50-12:00pm **EECS Theory Seminar** --- Anupam Gupta (Carnegie Mellon Univ) *Max-Min Facility Location and Set Coverage Problems Stream* --- CSE 3941

3:10-4:00pm **Applied and Interdisciplinary Mathematics Seminar** --- Alex Powell (Vanderbilt) *Rounding algorithms for redundant signal expansions* ---1084 EH

3:10-4:00pm **Student Geometry/Topology** --- Dave Constantine (UM) *Quasi-isometries of symmetric spaces* --- 3096 EH

4:10-5:00pm **Combinatorics** --- Vladimir Retakh (Rutgers) *Algebras associated to directed acyclic graphs* --- 3866 EH

**EVENTS THIS WEEK**

**Midwest Dynamical Systems Conference**

Friday-Sunday, October 19-21, 2007

**Organizer: Carl Simon (Center for the Study of Complex Systems & UM)**

All sessions in 1360 EH

*(Titles and schedule listed on the back pages of the bulletin)*

**OSU/UM Algebraic Geometry Workshop**

Saturday & Sunday, October 20 & 21, 2007

B844 EH

**Speakers: Patrick Brosnan, William Fulton, Sandor Kovacs, Mihnea Popa**

*(Titles and schedule TBA)*

**UPCOMING EVENTS**

**Rainich Lecture**

Jan. 15-17, 2008

**Speaker: Gang Tian**

**Ziwet Lecture**

Feb. 5, 2008

**Speaker: Curtis McMullen**

**ABSTRACTS FOR THE WEEK OF OCT. 15 – OCT. 21, 2007**

**“What is ... ” Seminar**  
**Tuesday, October 16, 2:10-3:00pm**  
**3096 EH**  
**Selim Esedoglu (UM)**  
***What is ... the Mumford-Shah functional?***

Mumford and Shah's variational model for image segmentation is one of the best known and influential mathematical models in image processing and computer vision. It poses image segmentation (which means partitioning a given image into regions containing distinct objects) as an optimization problem. It has been adapted to many other applications since its inception, both in and outside of image processing. Its analysis and computation motivated lots of interesting mathematics. I will describe some of these.

**Algebraic Geometry Seminar (Special Lectures on Branchvarieties)**  
**Tuesday, October 16, 3:10-4:00pm**  
**3088 EH**  
**Allen Knutson (UCSD)**  
***Schubert varieties in G/B are normal and Cohen-Macaulay***

I'll use a variant of the second theorem from the last lecture to give an inductive and wholly geometric proof of this fact, usually proved using Frobenius splitting. (Another proof using very little sheaf cohomology was given by Brion.)

The proof also implies the following: any Schubert variety is covered by T-invariant open affine patches, which have flat T-equivariant degenerations to Stanley-Reisner schemes. This had been known for various flavors of Grassmannians, but doesn't seem to have been observed before in this generality.

**Geometric Function Theory Seminar**  
**Wednesday, October 17, 3:10-4:00pm**  
**4096 EH**  
**Steffen Rohde (U of Washington)**  
***Random Quasiconformal Maps***

I will explain how random homeomorphisms appear naturally in the study of Schramm's Loewner evolution SLE (via conformal welding in the SLE trace), and how qc maps could be useful in the study of SLE.

Then I will discuss two toy models for random qc maps.

**Working Seminar in Several Complex Variables and Complex Dynamics**  
**Wednesday, October 17, 4:10-5:30pm**  
**4088 EH**

**Andrei Iordan (Institut de Mathematiques de Jussieu)**

***Complex tangential curves of constant curvature in the unit ball of  $\mathbb{C}^2$  and homogeneous polynomials***

We prove that a non-constant homogeneous polynomial  $P$  on  $\mathbb{C}^2$  having the property that  $P=1$  on a complex-tangential real analytic curve of the boundary of the unit ball reduces to a monomial by a unitary change of variables. This is a positive answer to conjectures of H.O. Kim.

**Algebraic Geometry Seminar**  
**Wednesday, October 17, 4:10-6:00pm**  
**3088 EH**

**Claude Sabbah (Ecole Polytechnique)**  
***An extension of Hodge theory***

In this talk I will introduce the notion of (variation of) twistor structure, as an extension of the notion of (variation of) Hodge structure, following C. Simpson. I will explain the usefulness of this notion for proving the decomposition theorem for projective morphisms and semisimple representations of the fundamental group of (quasi)projective varieties over the complex numbers, after the work of T. Mochizuki and myself. I will end with some perspective on semisimple representations of the wild fundamental group.

**Student Algebraic Geometry Seminar**  
**Thursday, October 18, 2:10-3:00pm**  
**3866 EH**

**Wansu Kim (UM)**  
***An Overview of Deligne-Illusie 2***

The degeneration of the Hodge spectral sequence for a smooth proper scheme of characteristic 0 is a basic fact in algebraic geometry. Since the statement can be made purely algebraic (i.e. it can be stated without using any complex analysis), it is natural to expect a purely algebraic proof.

In this talk, I would like to present a purely algebraic proof of this fact, following Deligne-Illusie('87). This proof is quite surprising in two aspects. First, the proof is by reduction to the case where the base field is of positive characteristic. Note that there are many examples of smooth projective surfaces in positive characteristic for which the degeneration of the Hodge spectral sequence fails to hold. Deligne-Illusie proved the degeneration in positive characteristic under extra hypotheses (upper bound on dimension and liftability), from which they deduced the statement in characteristic 0. Second, the proof is short and elementary, contrary to our expectations on Deligne, Illusie and characteristic  $p$ . The key technical inputs are 1) Cartier Isomorphism ('57 by Cartier, different proof by Grothendieck) and 2) basic deformation theory, and none of them are hard results.

From the characteristic  $p$  statement, one can deduce Kodaira vanishing theorem (for smooth projective schemes), both in characteristic  $p$  under extra hypotheses and in characteristic 0, by the argument due to Raynaud. It is worth noting that the proof is important not just because it gives a purely algebraic proof of the degeneration of Hodge spectral sequence, but because it provides a useful tool to study algebraic geometry in positive characteristic.

To minimize the background, I will state (and hopefully provide some intuition on) certain properties of smooth morphisms we need. Spectral sequences will not appear in the proof.

**Study Seminar (Pt. 1) & (Pt. 2)**  
**Thursday, October 18, (Pt. 1) 2:10-3:00 & (Pt. 2) 3:10-4:00**  
**(Pt. 1) 3096 EH & (Pt. 2) 4088 EH**  
**Pekka Pankka (UM)**  
***The mapping class group V***

Let  $S$  be a smooth closed simply connected 2-manifold. By definition the mapping class group of  $S$  is the quotient  $M(S) = \text{Homeo}^+(S)/\text{Homeo}_0(S)$ , where  $\text{Homeo}^+(S)$  is the group of all orientation preserving homeomorphisms on  $S$  and  $\text{Homeo}_0(S)$  is the group of all homeomorphisms on  $S$  isotopic to the identity. In this talk we continue the discussion on the Nielsen-Thurston trichotomy of mapping classes.

**Commutative Algebra Seminar**  
**Thursday, October 18, 3:10-4:00pm**  
**3096 EH**  
**Mel Hochster (UM)**  
***Tor, Ext, and local cohomology .... continued***

For the first several weeks of the semester, I will be giving some talks on elementary homological algebra: the functors  $\text{Tor}$  and  $\text{Ext}$ , and then an introductory treatment of local cohomology. I will write up these lectures and make them available from my Web page. This is intended to supplement the background of students in Math 711, but others who are interested in this material are welcome.

**Topology Seminar**  
**Thursday, October 18, 3:10-4:00pm**  
**4096 EH**  
**Xiaojun Chen (UM)**  
***A chain model of the free loop space and string topology***

In this talk we will study the Frobenius structure on the chain complex of a smooth manifold, and then construct a chain (and also the equivariant chain) model of its free loop space. From such a chain complex we show that there is a Batalin-Vilkovisky algebra on its homology, which models the string topology of Chas-Sullivan. Some of the other structures on the loop space and their applications will also be discussed.

**Math Club**  
**Thursday, October 18, 4:10-5:00pm**  
**2nd Floor Nesbitt Room**  
**Jeff Lagarias (UM)**  
***The  $3x+1$  Problem***

The notorious  $3x+1$  problem considers the function  $C(n)$  on positive integers: if  $n$  is even, divide by 2, and if  $n$  is odd, multiply by 3 and add 1, so  $C(2n)=n$ ,  $C(2n+1)=6n+4$ . The  $3x+1$  Conjecture (or Collatz problem) is to show that starting from any positive integer  $n$  and iterating this function long enough, you will get to 1 (and then cycle through 1, 4, 2). This problem is unsolved. Despite its simple statement, it could well be the hardest problem in mathematics.

The talk will discuss why it is probably true, and why it is a really hard problem.

**EECS Theory Seminar**  
**Friday, October 19, 10:50-12:00pm**  
**CSE 3941**  
**Anupam Gupta (Carnegie Mellon Univ)**  
***Max-Min Facility Location and Set Coverage Problems Stream***

Consider the following problem: you want to locate  $k$  facilities to serve some set of demands arriving tomorrow. Unfortunately, you do not precisely know what the demand set will be --- you merely know that it will be one of  $M$  potential demand sets  $\{S_1, \dots, S_M\}$  given to you in advance, and that the actual demand set  $S_i$  will be chosen from these  $M$  sets by an adversary after seeing your solution.

Where should you place your facilities?

We consider the problems of locating these  $k$  facilities to minimize the worst-case cost suffered, or to maximize the worst-case profit collected, and give greedy-style algorithms for several such problems.

This is based on work with Barbara Anthony, Vineet Goyal, Carlos Guestrin, Andreas Krause, Viswanath Nagarajan (all at Carnegie Mellon University), and Brendan MacMahan (at Google, Pittsburgh).

**Applied and Interdisciplinary Mathematics Seminar**  
**Friday, October 19, 3:00-4:00pm**  
**1084 EH**  
**Alex Powell (Vanderbilt)**  
***Rounding algorithms for redundant signal expansions***

Redundancy is a key to practical and reliable data representation in many settings. Frame theory provides a mathematical framework for stably representing signals as linear combinations of an overcomplete collection of "basic building blocks." We shall discuss the problem of quantization (analog-to-digital conversion) for redundant finite frame expansions. Our focus will be on a special class of algorithms, known as Sigma-Delta schemes, which are related to error diffusion. We explain the basics of how Sigma-Delta schemes work in this setting and point to current directions of research (including error estimates, stability theorems, and reconstruction procedures).

**Student Geometry/Topology**  
**Friday, October 19, 3:10-4:00pm**  
**3096 EH**  
**Dave Constantine (UM)**  
***Quasi-isometries of symmetric spaces***

In this talk I'll survey a result by Kleiner and Leeb stating that a quasi-isometry of a higher rank symmetric space is a finite distance from an isometry. The talk will be a very loose sketch of the proof, with a focus on the many diverse tools from analysis, geometry, topology and even logic that go into proving it. Besides quasi-isometries, we'll see bi-Lipschitz maps, asymptotic cones, ultrafilters, buildings, local homology groups etc.

**Combinatorics**  
**Friday, October 19, 4:10-5:00pm**  
**3866 EH**  
**Vladimir Retakh (Rutgers)**  
***Algebras associated to directed acyclic graphs***

We construct and study a class of algebras associated to generalized layered graphs, i.e. directed graphs with a ranking function on their vertices and edges. Each finite directed acyclic graph admits a structure of a generalized layered graph. We construct linear bases in such algebras, compute their Hilbert series, and discuss their Koszulity and other properties. Our interest to generalized layered graphs and algebras associated to those graphs is motivated by their relations to factorizations of polynomials over noncommutative rings.

This is joint work with Robert Wilson.

Tentative Schedule and Arrangements  
**Midwest Dynamical Systems Conference**  
October 19-21, 2007

The University of Michigan

Organizer: Carl Simon (Center for the Study of Complex Systems and Department of  
Mathematics)

All sessions in 1360 East Hall

**Friday, October 19**

2-2:50 Anthony Bloch (Michigan)

Integrable Geodesic Flows on the symmetric and skew-symmetric matrices.

3-3:50 Sebastian Marotta (Boston University)

Singular Perturbations of  $z \rightarrow z^n$  with Multiple Poles

Refreshments

4-4:50: Steve Batterson (Emory): The Grandfather of American Mathematics and the Dynamics  
of Meteor Showers

5-5:50 Youngna Choi (Montclair State)

Attractors of Two-Piece Expanding Maps

**Saturday, October 20**

**In Celebration of the (almost) Fortieth Anniversary of the August 1968 Berkeley Global  
Analysis Conference**

9-9:45 John Franks (Northwestern):

Global Fixed Points for Surface Actions and Morita's Theorem

10-10:50 Robert F. Williams (Texas)

Higher Dimensional Continued Fractions and Positive Matrices

11-11:50 Chris Novak (Northwestern)

Distortion elements and Discontinuity Growth in the Interval Exchange Group

12-1:30 Lunch

1:30-2:20 Morris Hirsch (Wisconsin/Berkeley)

TBA

2:30-3:20 Charles Pugh (Toronto)

Focal Stability (with Mauricio Peixoto)

4-4:50 Johannes Grote (Michigan State)

Sharp rigorous enclosures of invariant manifolds and homoclinic points and construction of symbolic dynamics (with Martin Berz, Kyoko Makino and Sheldon Newhouse)

6-9 Banquet

## **Sunday, October 21**

9-9:50 Kamlesh Parwani (Eastern Illinois)

$C^1$  actions of the mapping class group on the circle.

10-10:50 Xie Zhifu (Virginia State)

Bifurcation of 4-Body Central Configurations with Three Equal Masses

11-11:45 Bruce Peckham (Minnesota Duluth)

Cusp-cusp Bifurcation for Non-invertible Maps of the Plane

There is partial NSF support available to graduate students and non-tenured faculty for travel and lodging. Send Carl Simon (cpsimon@umich.edu) an e-mail with information about your interest. There are funding limits per person, \$200 to \$600 depending on distance and mode of travel.

The hotel for the October 19-21, 2007 meeting of the Midwest Dynamical Systems Meeting is:

Holiday Inn North Campus

3600 Plymouth Rd.

Ann Arbor, MI 48105

(734) 769-9800

1-800-800-5560

<http://www.hiannarbor.com/>

When making reservations mention "Midwest Math Meeting". The rate for rooms will be \$92.00/night if made yesterday (actually by September 28).

(There is van service to the University from this hotel. A van will bring people from the conference to the hotel Saturday at 8 am.)

The Conference will meet in Room 1360 East Hall, in the mathematics department. East Hall is near the corner of East University and South University Avenues, next to Ulrich's Bookstore. There is a public parking lot one block to the southeast, on Forest Street, just off South University.

For those attending, please send an email to hoishi@umich.edu indicating travel mode and times and local residence (for possible coordination attempts). For those not attending, please send a notarized excuse from your physician.

The nearest airport is the Detroit Metro Airport, about 25 miles away.