Schedule

Plenary session : November 16, 2011, Room 101, Bldg. 129

15:00–15:20	Registration	
15:20–15:30	Welcoming remarks	In-Sok Lee, SNU
15:30–16:00	Extended Harnack inequality	Hiroaki Aikawa, HU
16:10-16:40	Conservativeness of non-symmetric diffusion processes generated by perturbed divergence forms	Gerald Trutnau, SNU
16:50–17:20	A general regularity theorem for weak mean curvature flow	Yoshihiro Tonegawa, HU
17:30–18:00	On Stein's square function	Sanghyuk Lee, SNU

Parallel session I: November 17, 2011, Room 301, Bldg. 129

09:00–09:30	Boundedness of Calderon-Zygmund Operators on Matrix weighted L^p	Hyun-Kyoung Kwon, SNU
09:40–10:10	Weak solutions for the derivative nonlinear Schrödinger equation	Hideo Takaoka, HU
10:10–10:30	Coffee Break	
10:30–11:00	On convergence of the Schrödinger equations	Chu-Hee Cho, SNU
11:10–11:40	Asymptotic behavior of the critical two-point functions for long-range statistical-mechanical models in high dimensions	Akira Sakai, HU
11:40–13:10	Lunch and discussion	
13:10–13:40	Harmonic Bergman spaces over the ball and the half-spaces	Kyesook Nam, SNU
13:50–14:20	Modulus of continuity of harmonic quasiconformal mapping	Tsubasa Itoh, HU
14:30–15:00	Oscillation of harmonic functions for subordinate Brownian motion and its applications	Yunju Lee, SNU

Parallel session II: November 17, 2011, Room 220, Bldg. 27

09:00–09:30	Hypersurfaces evolving by α-Gauss Curvature	Lami Kim, SNU
09:40–10:10	Eigenvalues of the elliptic operator including a large nonlocal term	Shuichi Jimbo, HU
10:10–10:30	Coffee Break	
10:30–11:00	Asymptotic behavior in parabolic nonlinear equations and its application to elliptic eigenvalue problems	Soojung Kim, SNU
11:10–11:40	Gradient estimates and existence of mean curvature flow with transport term	Keisuke Takasao, HU
11:40–13:10	Lunch and discussion	
13:10–13:40	Hölder regularity for solutions of the evolutional p-Laplace equation with external forces	Masashi Mizuno, HU
13:50–14:20	The viscosity method for the homogenization of soft inclusion	Minha Yoo, SNU
14:30–15:00	Clearing-Out Lemma for mean curvature flow with transport term	Kota Kasai, HU

Titles and Abstracts

Extended Harnack inequality

Hiroaki Aikawa, Hokkaido University, Japan

The Harnack inequality is one of the most fundamental inequalities for positive harmonic functions and, more generally, for positive solutions to elliptic equations and parabolic equations (De Giorgi-Nash-Moser theory). This talk gives a different view point of generalization. Namely, we generalize Harnack chains rather than equations. More precisely, we allow a *small exceptional set* in the Harnack chain and yet we obtain a similar Harnack inequality. In light of inextricable relationships between harmonic functions and Brownian motions, such a generalization is plausible. However, it is not so easy to give a rigorous formulation. We introduce a *Harnack double chain* in association with quasihyperbolic metric and measure the size of an exceptional set by capacity. We observe that an extended Harnack inequality gives a boundary Harnack principle for a very nasty domain.

Conservativeness of non-symmetric diffusion processes generated by perturbed divergence forms

Gerald Trutnau, Seoul National University, South Korea

Let $E \subset \mathbb{R}^d$, $d \geq 2$ be an unbounded domain that is either open or closed. If it is closed we assume that the boundary is locally the boundary of an extension domain. We present conservativeness criteria for (possibly reflected) diffusions with state space E and generator L, which in the interior of E is given informally by

$$Lf = \frac{1}{2} \sum_{i,j=1}^{d} \partial_j (a_{ij} \partial_i f) + \sum_{i=1}^{d} B_i \, \partial_i f.$$

Here the diffusion matrix (a_{ij}) is allowed to be non-symmetric, is merely assumed to consist of measurable functions, and satisfies locally a strict ellipticity condition. $B = (B_1, ..., B_d)$ is a divergence free vector field that satisfies some sector condition. Our main tool is a recently extended forward and backward martingale decomposition which reduces to the well-known Lyons-Zheng decomposition in the symmetric case. This talk is based on joint work with Masayoshi Takeda (Tohoku University).

A general regularity theorem for weak mean curvature flow

Yoshihiro Tonegawa, Hokkaido University, Japan

I will discuss my recent joint work with Kota Kasai on partial regularity theorem for Brakke's mean curvature flow. It generalizes Allard's regularity theorem to parabolic setting and also gives a new proof for Brakke's partial regularity theorem.

On Stein's square function

Sanghyuk Lee, Seoul National University, South Korea

In this talk we prove a weighted norm inequality for Stein's square function and the maximal Bochner-Riesz operator. This yields new L^p bounds for a class of radial Fourier multiplier operators as well as space-time regularity results for the wave and Schrödinger equations. The talk is based on a recent work with Keith Rogers and Andreas Seeger.

Boundedness of Calderon-Zygmund Operators on Matrix weighted L^p

Hyun-Kyoung Kwon, Seoul National University, South Korea

This is a preliminary report on an ongoing work with J. Isralowitz where we reduce the problem to that of paraproducts. The Carleson Embedding Theorem is the crucial tool needed for this weighted norm inequality.

Weak solutions for the derivative nonlinear Schrödinger equation

Hideo Takaoka, Hokkaido University, Japan

We study the periodic solutions of a derivative nonlinear Schrödinger equation. We give a priori estimates and local existence results in H^s for some $s < 1/2$. An example of irregular initial condition is the form whose Fourier coefficients are expressible under the Gaussian randomization, and it should not be controlled by the $H^{1/2}$ norm.

On convergence of the Schrödinger equations

Chu-Hee Cho, Seoul National University, South Korea

In this talk, we consider several variants of almost everywhere convergence problem for the Schrödinger equation.

Asymptotic behavior of the critical two-point functions for long-range statistical-mechanical models in high dimensions

Akira Sakai, Hokkaido University, Japan

We consider long-range self-avoiding walk, percolation and the Ising model on the d-dimensional integer lattice Z^d that are defined by power-law decaying pair potentials of the form $D(x) \approx |x|^{-d-\alpha}$ for some $\alpha > 0$. These models are known to exhibit critical behavior as the parameter p, such as the inverse temperature for the Ising model, tends to its critical value p_c. Let d_c be $2(\alpha \wedge 2)$ for self-avoiding walk and the Ising model and be $3(\alpha \wedge 2)$ for percolation. I will explain the result of joint work in progress with Lung-Chi Chen that,if $\alpha \neq 2$ and $d > d_c$ and the spread-out parameter L is sufficiently large, then the critical two-point function $G_{p_c}(x)$ for each model, such as the spin-spin correlation function for the critical Ising model, is asymptotically a multiple of $|x|^{\alpha\wedge 2-d}$. The proof is based on application of the lace expansion and analysis of Green's function for random walk whose step-distribution is D.

Harmonic Bergman spaces over the ball and the half-spaces

Kyesook Nam, Seoul National University, South Korea

In this talk, we introduce the harmonic Bergman space and characterize the harmonic Bergman spaces by means of integrability conditions of double integrals associated with difference quotients of harmonic functions. We also give the characterization of the harmonic Bergman spaces for the critical case which is missing in the result for the holomorphic case. The talk is based on a joint work with B.R.Choe.

Modulus of continuity of harmonic quasiconformal mapping

Tsubasa Itoh, Hokkaido University, Japan

Let D and D' be bounded domains in R^n with $n \geq 2$ and f be a quasiconformal mapping of D onto D'. It is well known that f is locally Hölder continuous in D. In general, however, f may not be global Hölder continuous in D. Assume that f is continuous up to the boundary of D. We prove that if f has improved continuity on the boundary of D,then f has improved continuity in $\overline{D}$. Moreover, we assume, in addition to quasiconformality, that f is harmonic. We show that if the boundary of D is uniformly perfect,then more improved continuity on the boundary of D ensures more improved continuity in $\overline{D}$ in the context of general modulus of continuity.

Oscillation of harmonic functions for subordinate Brownian motion and its applications

Yunju Lee, Seoul National University, South Korea

In this talk, we establish an oscillation estimate of nonnegative harmonic functions for a large class of integro-differential operators. Such operators are the infinitesimal generators of pure-jump subordinate Brownian motion. As an application, we give a probabilistic proof of relative Fatou theorem for harmonic functions for the integro-differential operators in bounded κ-fat open set. That is, if u is a positive harmonic function in a bounded κ-fat open set D and h is a positive harmonic function in D vanishing on D^c, then the non-tangential limit of u/h exists almost everywhere with respect to the Martin-representing measure of h. Under the gaugeability assumption, relative Fatou theorem is true for operators obtained from the generator of pure-jump subordinate Brownian motion in bounded κ-fat open set D through non-local Feynman-Kac transforms.

Hypersurfaces evolving by α-Gauss Curvature

Lami Kim, Seoul National University, South Korea

We study the deformation of the 2-dimensional convex surfaces in $\mathbb{R}^3$ whose speed at a point on the surface is proportional to α-power of positive part of Gauss Curvature. First, for $1/2 < \alpha \leq 1$ we show that there is smooth solution if the initial data is smooth and strictly convex and that there is a viscosity solution with $C^{1,1}$-estimate before the collapsing time if the initial surface is only convex. Moreover, we show that there is a waiting time effect which means the flat spot of the convex surface will persist for a while. We also show the interface between the flat side and the strictly convex side of the surface remains smooth on $0 < t < T_0$ under certain necessary regularity and non-degeneracy initial conditions, where T_0 is the vanishing time of the flat side.

Eigenvalues of the elliptic operator including a large nonlocal term

Shuichi Jimbo, Hokkaido University, Japan

I consider the eigenvalue problem of the elliptic operator $-\Delta + \tau B$ in a bounded domain Ω(under the Dirichlet B.C.). Here B is given as follows

$$B[u] = \sum_{j=1}^{N} (u, \phi_j)_{L^2(D)} \phi_j \qquad (u \in L^2(\Omega))$$

by a finite orthogonal system $\phi_1, \phi_2, \cdots, \phi_N$ in $L^2(\Omega)$. It is known that $k-$the eigenvalue of this operator is monotone increasing with the parameter $\tau \geqq 0$ in τ and bounded. So it necessary approaches some limit value. I will talk about this asymptotic behavior for τ tends to infinity.

Asymptotic behavior in parabolic nonlinear equations and its application to elliptic eigenvalue problems

Soojung Kim, Seoul National University, South Korea

We study the asymptotic profiles of the fully nonlinear degenerate parabolic flows $u_t = F(D^2 u^m)$ for $m \geq 1$ to show the geometric properties of the following fully nonlinear eigenvalue problems:

$$F(D^2\phi) + \mu\phi^p = 0, \quad \phi > 0 \quad in \quad \Omega,$$

$$\phi = 0 \quad \text{on} \quad \partial\Omega,$$

posed in a smooth convex domain Ω for $0 < p \leq 1$. This is a joint work with Ki-ahm Lee.

Gradient estimates and existence of mean curvature flow with transport term

Keisuke Takasao, Hokkaido University, Japan

In this talk we consider a hypersurface of the graph of the mean curvature flow with transport term. The existence of the mean curvature flow with transport term was proved by Liu, Sato and Tonegawa by using geometric measure theory. We give a proof of the gradient estimates and the short time existence for the mean curvature flow with transport term by applying the backward heat kernel.

Hölder regularity for solutions of the evolutional p-Laplace equation with external forces

Masashi Mizuno, Hokkaido University, Japan

We consider the interior regularity problem for the gradient of solutions of the evolutional p-Laplace equation with the external forces of divergence type. Since the equation is a degenerate parabolic equation, optimal regularity of the gradient is Hölder continuous. We give a natural condition of the external force for the Hölder continuity of the gradient of solutions.

The viscosity method for the homogenization of soft inclusion

Minha Yoo, Seoul National University, South Korea

In this talk, we consider periodic soft inclusions T_ϵ with periodicity ϵ, where the solution , u_ϵ, satisfies semi-linear elliptic equations of non-divergence in $\Omega_\epsilon = \Omega \setminus \overline{T}_\epsilon$ with a Neumann data on ∂T^a. The main object is developing a viscosity method to find the homogenized equation satisfied by the limit of u_ϵ, called as u, as ϵ approaches to zero. We introduce the concept of a compatibility condition between the equation and the Neumann condition on the boundary for the existence of uniformly bounded periodic first correctors. The concept of second corrector has been developed to show the limit, u, is the viscosity solution of a homogenized equation.

Clearing-Out Lemma for mean curvature flow with transport term

Kota Kasai, Hokkaido University, Japan

We consider the regularity of a weak solution for mean curvature flow with transport term. Even if a surface area is small, it can be complicated. However the smoothing effects by mean curvature flow remove such complicated parts for a short time. The proposition which describes such property is called "Clearing-Out Lemma". It is one of an important result for the regularity theory for mean curvature flow. We talk about that "Clearing-Out Lemma" also holds under a background flow field which belongs to suitable integrability class.