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2014년도 충청수학회 연구발표회

고려대학교 세종캠퍼스

May 24, 2014 (Saturday)

(* : 발표자)

일시 : 2014년 5월 24일(토) 09:00 ∼19:40

장소 : 고려대학교 세종캠퍼스

주최 : 충 청 수 학 회

주관 : 고려대학교 세종캠퍼스 수학과

초청강연

IN-1-1 최영한 (KAIST, 한국수학교육학회 명예회장) : 어떻게 하면 학생들이 수학을 즐겁게 배울 수 있을까?

OECD는 서기 2000년부터 매 3년 마다 참여국에서 무작위로 선정한 학교에서 만 15세의 학생을 대상으로 읽기, 수학, 과학에 관한 시험 및 조사를 실시하고 분석 (PISA: Program for International Student Assessment)한다. 시험(조사 포함)은 두 시간 동안 open-ended 형식과 여러 보기 중에서 고르는 형식으로 구성되어 있다. 2012년에 실시하고 2013년 12월3일에 발표한 PISA 2012의 중점 과목은 수학으로 수학에 대한 자신감, 흥미 등 정서적인 특성이 분석 항목에 들어 있었다. PISA 2012는 모두 65개국 (34 OECD 회원국과 21 비회원국)에서 51만 명의 학생들이 참여 하였으며 우리나라는 수학 성적은 최상위였지만 수학에 대한 흥미 등 정서적인 항목은 최하위였다. 많은 학부모들은 수학을 중요한 교과로 여기고 그들의 자녀들을 조기 교육의 마당(가정 학습지 또는 영재 학원)에 보내고 있다. 그러나 그들은 수학의 내용이나 배움의 과정을 중요하게 여겨 일찍부터 수학의 본질을 깨우치게 하는 것이 아니다. 그래서 학생들은 부모들의 영향력이 비교적으로 줄어드는 대학에서는 수학을 열심히 하겠다는 생각을 하지 않고 있다. 이어폰을 꼽고 음악을 들으면서 수학 강의를 듣는 학생들도 종종 볼 수 있다. 학생들의 수학에 대한 흥미의 저하와 기피 현상은 곧바로 이공계를 전공하겠다는 학생 수의 감소로 이어진다. 청년 실업자는 해마다 늘어나지만 웬만한 중소기업은 제대로 된 일꾼을 구하지 못한다. 지난 3월 국회는 초, 중, 고등학교의 수업과 방과 후 수업에서 선행 학습을 금지하고 초, 중, 고등학교와 대학 입학 전형에서 선행 학습을 유발하는 전형을 금지하는 내용을 담은 “공교육 정상화 촉진 및 선행교육 규제에 관한 특별법” (법률 제12395호)을 제정하였고 이 법은 올해 9월 12일부터 시행하게 된다. 우리는 수학이 많은 학생들로부터 외면당하고 있다는 사실을 알아야 한다. 제대로 된 수학을 배움으로써 배움의 즐거움을 느끼고 문제 해결에서 창의력을 발휘하는 것이 우리의 바람일 것이다. 과연 이 법으로 우리의 바람이 이루어질 수 있을까?

초청강연

IN-2-1 박형주 (POSTEC, NIMS 수학원리응용쎈터장) : 연구교류 프로그램을 통한 수학발전과 서울세계수학자대회

독일의 Oberwolfach 연구소와 미국의 MSRI, IMA와 같은 세계적인 수학 연구소는 연구교류를 통한 수학발전이라는 모델을 보여준다. 이러한 모델을 국내에서 구현하는 것이 가능할지에 대한 논의를 해보고자 한다. 또한 서울세계수학자대회가 이러한 연구교류의 중요한 자산이 되도록 하기 위한 노력도 필요한 시점이다.

제 1발표장 (제2과학기술관 2층 217호실)

1-1 Imsoon Jeong(*)(경북대), Young Jin Suh(경북대) and Changwa Woo(경북대) : Characterizations of real hypersurfaces in complex two-plane Grassmannians whose the structure Jacobi operator is recurrent

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In this talk, we introduce a new notion of recurrent structure Jacobi operator, that is, $(\nabla_X R_\xi)Y = \omega(X)R_\xi Y$ for any tangent vector fields X and Y on a real hypersurface M in complex two-plane Grassmannians $G_2(C^{m+2})$, where R_ξ denotes the structure Jacobi operator of M in $G_2(C^{m+2})$ and ω a certain 1-form on M in $G_2(C^{m+2})$. This notion is weaker than parallel structure Jacobi operator, that is, $\nabla R_\xi = 0$. Next, in $G_2(C^{m+2})$, we prove that there do not exist any Hopf hypersurfaces with recurrent structure Jacobi operator.

1-2 KIWAN JEON[1](NIMS), CHI YOUNG AHN[1](NIMS), AND SUNGWHAN KIM[2](한밭대) : A NEW METAL ARTIFACT REDUCTION ALGORITHM IN X-RAY COMPUTED TOMOGRAPHY

X-ray Computed Tomography (CT) is an imaging modality for providing $2-D$ and $3-D$ high-resolution tomographic images of the scanned human body from measured X-ray projections. Despite the controversy about the hazards associated with exposure to X-ray radiation, CT is a powerful tool to investigate the interior of the human body, and has been widely used for diagnostic and therapeutic purposes in various medical disciplines for decades. CT can provide high-resolution anatomic images in the absence of metallic objects such as dental fillings or prosthesis in the scanning path, but on the other hand metallic objects implanted in the human body cause severe metal streak artifacts in CT images and deteriorate reconstructed CT image quality. Usually metals are strongly attenuating objects and the detectors sensing X-ray beam attenuated by metals undergo severe photon starvation and thus after-log projection data become inaccurate.

If there are metals located in the X-ray scanned object, a point outside the metals has its range of projection angle at which projections passing through the point are disturbed by the metals. Roughly speaking, this implies that attenuation information at the point is missing in the blocked projection range. So conventional projection completion MAR algorithms to use the undisturbed projection data on the boundary of the metal trace is less efficient in reconstructing the attenuation coefficient in detailed parts, in particular, near the metal region. In order to overcome this problem, we propose the algebraic correction technique (ACT) to utilize an pre-reconstructed interim image of the attenuation coefficient outside the metal region which is obtained by solving a linear system designed to reduce computational costs. The reconstructed interim image of the attenuation coefficient is used as prior information for MAR. Numerical simulations support that the proposed correction technique shows better performance than conventional inpainting techniques such as the total variation and the harmonic inpainting.

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1-3 Ho Won Choi(*)(고려대) and Kee Young Lee(고려대) : THE SELF CLOSENESS NUMBER AND WEAK HOMOTOPY DECOMPOSITION

For any CW complex X, there exist a weak homotopy system and the self closeness number of X. In this paper, we investigate that a weak homotopy system and the self closeness number have certain connections. This results show that the self closeness number of $X^{(m)}$ is dominated by the self closeness number of X and determine that self homotopy classes set and groups of a weak homotpy system.

1-4 Min Kyu Kim(경인교대) : The Betti numbers of Hamiltonian circle action with isolated fixed points

Let (M, ω) be an eight-dimensional closed symplectic manifold equipped with a Hamiltonian circle action with only isolated fixed points. Then, the Betti numbers of M satisfy $b_0(M) \leq b_2(M) \leq b_4(M)$.

1-5 이진호(*)(고려대),이기영(고려대) : Classification of components of the mapping spaces Map($\Sigma^m \mathbb{H}P^2, S^n$)

We compute cohomotopy groups of suspended quaternionic projective planes $\pi^n(\sum^m \mathbb{H}P^2)$ by using composition methods. We classify all evaluation fibrations $\omega_f : Map(\sum^m \mathbb{H}P^2, S^n; f) \to S^n$ as fibre homotopy equivalent by the generalized Whitehead product, where $Map(\sum^m \mathbb{H}P^2; f)$ is the path component of mapping space from $\sum^m \mathbb{H}P^2$ to S^n containing f. We compute some homotopy groups of unbased mapping spaces with different base points. Finally we classify path components of $Map(\sum^m \mathbb{H}P^2; f)$ up to homotopy equivalent.

1-6 [1]Tae Gyun Kim, [2]Cheon Seoung Ryoo, [3]Jong Jin Seo, and [4]Yu Seon Jang(∗) : Fourier series of the derived periodic functions from the Bernoulli and Euler polynomials

In this paper, we derive the new periodic functions from the Bernoulli and Euler polynomials. And then we give the Fourier series of the derived periodic functions from Bernoulli and Euler polynomials, we have the relation between the derived periodic functions from Bernoulli and Euler polynomials by using the Fourier series.

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1-7 Hark-Mahn Kim(충남대) and Hwan-Yong Shin(*)(충남대) : Stability for Euler-Lagrange Type Functional Equation in non-Archimedean space

In this talk, we give the general solutions of the Euler-Lagrange Type quadratic functional equation

$$f(x+ny)+f(y+nz)+f(z+nx)$$
$$=nf(x+y+z)+(n^2-n+1)[f(x)+f(y)+f(z)]$$

and investigate its generalized Hyers-Ulam stability in a non-Archimedeam spaces, where $n>1$.

1-8 Teakyun Kim(광운대), Hyuck-In Kwon(*)(광운대) : Functional equations associated with generalized Bernoulli numbers and polynomials

In this talk, we investigate the functional equations of the multiple Dirichlet and Hurwritz L-functions associated with Bernoulli numbers and polynomials attached to Dirichlet character.

제 2발표장 (제2과학기술관 2층 227호실)

2-1 지운식 (Un Cig Ji,충북대) : Quantum Extension of Girsanov Theorem

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Based on quantum white noise theory, we study some implementation problems, related to basic quantum stochastic processes, in terms of differential equations for white noise operators with respect to the quantum white noise derivatives, and, as an application, we study a unitary equivalence of basic quantum stochastic processes which induces a quantum extension of the (classical) Girsanov theorem.

2-2 Ick-Soon Chang(충남대) : Approximate derivations and related functional inequalities

Let $\mathcal{A}$ be a normed algebra over the real or complex field $\mathbb{F}$. An additive mapping $f : \mathcal{A} \to \mathcal{A}$ is said to be an *approximate derivation* if $\|f(xy) - xf(y) - f(x)y\| \leq \varepsilon$ is fulfilled for all $x, y \in \mathcal{A}$. An additive mapping $f : \mathcal{A} \to \mathcal{A}$ is called an *approximate left derivation* if $\|f(xy) - xf(y) - yf(x)\| \leq \varepsilon$ holds for all $x, y \in \mathcal{A}$. An additive mapping $f : \mathcal{A} \to \mathcal{A}$ is said to be an *approximate left Jordan derivation* if $\|f(xy + yx) - 2xf(y) - 2yf(x)\| \leq \varepsilon$ is fulfilled for all $x, y \in \mathcal{A}$. In addition, if $f(lx) = lf(x)$ is valid for all $l \in \mathbb{F}$ and all $x \in \mathcal{A}$, then we say that f is *linear*.

We first take into account the following functional inequality which expand the functional inequality in [H.-M. Kim, I.-S. Chang, Appl. Math. Lett. **25** (2012), no. 5, 830–836] :

$$\Big\| \sum_{i=1}^{l} s_i f(x_i) \Big\| \leq \Big\| f\Big(\sum_{i=1}^{l} s_i x_i \Big) \Big\|.$$

Especially, we show that every approximate left derivation on a semiprime normed algebra maps the algebra into its center and then by using this fact, we prove that and every approximate linear left derivation on a semisimple Banach algebra is continuous. Moreover, we deal with some results and stability for the functional inequalities related to left Jordan derivations.

2-3 김준형(*)(한남대),김성운(한남대) : Complex and quaternionic hyperbolic Fuchsian groups

In the beginning of my talk, I will introduce the complex/quaternionic hyperbolic geometry. And then, I'll give the characterization of Fuchsian groups acting on complex/quaternionic hyperbolic spaces.

2-4 Sung-Geun Lim(목원대) : On the two identities found in Ramanujan's lost notebook

In this talk, we introduce two incorrect identities found on page 336 in Ramanujan's lost notebook. Although we do not have correct versions of these identities, we hope that the ideas and partial results might provide insights to others.

2-5 [1]Alexander J. Diesl, [2]Chan Yong Hong, [3]Nam Kyun Kim(*), [4] Pace P. Nielsen :
Properties which do not pass to classical rings of quotients

A fundamental construction in ring theory is the formation of the field of quotients of a commutative domain. The utility of this construction lies in the fact that one moves from a decent ring structure (integral domain) to a nearly perfect structure (field). One of Ore's celebrated theorems states that something similar is true for noncommutative rings. In modern terminology this theorem says that the right Ore domains are exactly the right orders in division rings. More generally, if we are given a right Ore ring R with a property $\mathcal{P}$ we can ask whether its (total) right classical ring of quotients Q also has property $\mathcal{P}$. It turns out that in general the answer is no, and one can lose nice properties by passing to quotients.

Definition. Let R be a ring and let $a, b \in R$.

(1) A ring is *Abelian* when its idempotents are central.

(2) A ring R is *Dedekind-finite* if for $a, b \in R$, $ab = 1$ implies $ba = 1$.

(3) A ring R is *semicommutative* if $ab = 0$ implies $aRb = 0$

(4) A ring R is said to be *NI* if the set of nilpotent elements, $N(R)$, is an ideal.

(5) A ring R is *2-primal* if the prime radical equals the set of nilpotent elements, i.e. $P(R) = N(R)$.

In this paper, we focus on constructing examples demonstrating that many well-known zero-divisor properties do not pass to rings of quotients. We construct examples of Ore rings satisfying some standard ringtheoretic properties for which the classical rings of quotients do not satisfy those properties. Examples of properties which do not pass to rings of quotients include: Abelian, Dedekind-finite, semicommutative, 2-primal, and NI. In the process of constructing these examples we correct the literature. We also introduce two important construction techniques.

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2-6 김세정(충북대) : An approach of the Log-Euclidean mean with matrix geometric mean

In this talk we introduce a new type of Lie-Trotter formula for two self-adjoint operators or positive definite operators. We show an extended Lie-Trotter formula for weighted Log-Euclidean mean of several positive definite operators given in terms of some weighted geometric means.

2-7 정재환(*)(단국대),권오상(East China Normal Univ.),Marshall Slemrod(Univ. of Wisconsin-Madison) : Asymptotic behavior of solutions to the viscous Burgers equation with a stationary source

In this talk, we consider the long-time asymptotics of solutions to the viscous Burgers equation with a stationary source g :

$$[u_t + (u^2)_x = \nu u_{xx} + g, \quad (x,t) \in \mathbf{R} \times (0,\infty).]$$

Here $\nu > 0$ is a viscosity constant and $g = g(x)$ is a positive time-independent source. We prove *local* L^p-convergence to a steady state; global convergence is not possible because the steady state is not in any L^p. Also we point out some interesting difference caused by the source term.

2-8 Junmi Park(충남대) : Closed sets with stably limit shadowing property are hyperbolic

Let f be a diffeomorphism on a closed smooth manifold M and Λ be a closed f-invariant subset of M. In this talk, we show that f has the C^1-stably limit shadowing property on Λ if and only if Λ is a hyperbolic basic set.

제 3발표장 (제2과학기술관 2층 223호실)

3-1 Yoon Hoe Goo*(한서대), Dong man Im(청주대), Chunmi Ryu(충남대) : Boundedness of perturbed functional differential systems

We consider the nonlinear nonautonomous differential system

$$x^{'}(t) = f(t, x(t)), \quad x(t_0) = x_0, \tag{1}$$

where $f \in C[\mathbb{R}^+ \times \mathbb{R}^n, \mathbb{R}^n]$, $\mathbb{R}^+ = [0, \infty)$ and $\mathbb{R}^n$ is the Euclidean n-space. We assume that the Jacobian matrix $f_x = \frac{\partial f}{\partial x}$ exists and is continuous on $\mathbb{R}^+ \times \mathbb{R}^n$ and $f(t, 0) = 0$. In this talk, we investigate the boundedness of perturbed functional differential system of (1)

$$y^{'} = f(t, y) + \int_{t_0}^{t} g(s, y(s))ds + h(t, y(t), Ty(t)), \quad y(t_0) = y_0,$$

where $f, g \in C[\mathbb{R}^+ \times \mathbb{R}^n, \mathbb{R}^n]$, $h \in C[\mathbb{R}^+ \times \mathbb{R}^n \times \mathbb{R}^n, \mathbb{R}^n]$, $f(t, 0) = g(t, 0) = 0$, $h(t, 0, 0) = 0$, and $T : C(\mathbb{R}^+, \mathbb{R}^n) \to C(\mathbb{R}^+, \mathbb{R}^n)$ is a continuous operator.

3-2 Bowon Kang(*)(충남대) and Namjip Koo(충남대) : Periodic points and homoclinic classes

Hyperbolic periodic points play a key role in the study of the dynamics of diffeomorphisms. Using hyperbolic periodic points one attempts to split the dynamics of C^1- generic diffeomorphisms into elementary pieces. For generic diffeomorphisms of $Diff^1(M)$, these elementary pieces are the chain components. Moreover, every chain component of f containing a periodic point p is the homoclinic class of p. In this talk we discuss some relations between periodic points and homoclinic classes.

3-3 황진아(*)(고려대), 신수연(고려대), 황운재(고려대) : Introduction to Guckenheimer structure

We consider the two dimensional Riemann problem for scalar conservation laws. The base points and base curves for shock and rarefaction wave are important tool for constructing the solution for $2-D$ Riemann problem. In 1975, Guckenheimer found an interesting structure in $2-D$ Riemann problem for scalar conservation laws.

We construct the numerical solution for Guckenheimer structure and analyze the solution by using characteristic analysis.

3-4 Manseob Lee(목원대) : Robustly chain transitive for vector fields

In this talk, we show that the robustly chain transitive set is hyperbolic if and only if every hyperbolic periodic points are in the set and has the same index.

Joint work with K. Lee

3-5 신수연(*)(고려대), 손성익(강릉원주대), 황운재(고려대) : Surface tension effects in vortex sheet

An interface between fluids subject to a parallel shear flow is unstable. This interfacial instability is known as Kelvin-Helmholtz instability and is one of the fundamental problems in fluid dynamics.

A vortex sheet is defined as a surface across which the tangential velocity is discontinuous, and is a model for the interface of a parallel shear flow. Surface tension arises from imbalance of intermolecular cohesive forces between two fluids. The computation of the vortex sheet with surface tension is a difficult task and there are several obstacles in developing numerical methods.

In this talk, we introduce numerical methods for the vortex sheet with surface tension.

3-6 Jumi Oh(*)(충남대), Keonhee Lee(충남대) : C^1-stably measure expansive flows

Let M be a C^∞-closed manifold, and denote by $\mathfrak{X}^1(M)$ the set of C^1-vector fields on M endowed with the C^1-topology. Denote by $\mathcal{ME}(M)$ the set of $\phi \in \mathfrak{X}^1(M)$ whose integrated flow is *measure expansive*, and by $\mathrm{int}(\mathcal{ME}(M))$ the C^1-interior of $\mathcal{ME}(M)$ in $\mathfrak{X}^1(M)$. For $\phi \in \mathfrak{X}^1(M)$, the following conditions are mutually equivalent.
(i) $\phi \in \mathrm{int}(\mathcal{ME}(M))$,
(ii) ϕ satisfies both Axiom A and the quasi-transversality condition.

3-7 Mohammad Reza Bagherzad (충남대) : Lorenz Attractors and Orbital Shadowing

Lorentz attractor is a partially hyperbolic set introduced by J. Guckenheimer. In 1984 Komuro showed that Lorenz attractors do not satisfy shadowing property, by using same technique we are going to show that they do not satisfy orbital shadowing property too.

3-8 Sangjin Kim(충남대) : Examples of measure expansive homeomorphism

In this talk, we introduce two examples that one is measure expansive but not expansive, the other is weak measure expansive but not expansive.

3-9 Soyean Kim(*)(충남대), Keonhee Lee(충남대) : Hyperbolic structure of weak measure expansive diffeomorphisms

In this talk, we introduce the notion weak measure expansiveness which is stably weaker than that of measure expansiveness, and show that any diffeomorphism on a compact smooth manifold belongs to the C^1-interior of the set of diffeomorphism with weak measure expansiveness if and only if it satisfies both Axiom A and the no-cycle condition.