

발표장 및 행사장 안내

등록처자연과학관 2층

초청강연 조형관 103호

연구발표장 제 1, 2발표장(자연과학관 506호, 507호)

정기총회 조형관 103호

임원회의자연과학관 514호

휴게실 자연과학관 515호

중식 교직원식당

리셉션교직원식당

논 문 초 록 집

2008년도 연 구 발 표 회

Vol. 21
May 2008

충 청 수 학 회

목 차

• 초청강연

IN-1 Future Prospects of the National Institute for Mathematical Sciences 조용승 (국가수리과학연구소)	1
--	---

• 제 1발표장

1-1 Some characterizations of the q -transfer operators 장이채* (건국대), 김태균 (강원대)	2
1-2 The degree-complexity of the defining ideal of a smooth integral curve 안재만 (공주대)	3
1-3 Lie bialgebra arising from Poisson bialgebra $U(\mathfrak{sp}_4)^\circ$ 오세권 (충남대), 현선화* (충남대)	3
1-4 Characterization of Gamma Distribution by Independent Property 임은혁* (단국대), 이민영 (단국대)	3
1-5 Numerical verification of solutions for some unilateral boundary value problems for second order equations 유천성 (한남대)	4
1-6 An Extremal function for Sobolev trace inequality 박영자 (호서대)	4
1-7 Asymptotic Error Constants of the k -fold Pseudo-Cauchy's Method for a Simple Zero 김영익 (단국대)	4
1-8 Derivation of the pseudo-parabolic equation for thin-film capacitances via homoge- nization 박희철 (단국대)	5
1-9 Analytic functions on surfaces embedded in Quaternions 박희철 (단국대), 권은정* (단국대)	5
1-10 대학 교양수학 교육의 효율성에 관한 소고 서종진* (한남대), 김주필 (한남대), 최은미 (한남대), 김상배 (한남대), 유천성 (한남 대)	6

• 제 2발표장

2-1 Topological Method and its Application to Dirichlet Boundary Value Problems 최규홍*(인하대), 정택선(군산대)	7
2-2 On a non-compact minimax theorem using weak concavelike condition 김원규*(충북대), 금상호(충북대)	8
2-3 Exponential dichotomy, structural stability and shadowing of nonautonomous linear difference equations Le Huy Tien(충남대)	8
2-4 Characterizations on 2-isometries 구세현(충남대)	9
2-5 h -stability of linear difference equations via n_∞ -quasisimilarity 구남집(충남대), 강보원*(충남대)	9
2-6 Positive coexistence of a Lotka-Volterra type simple food-chain model 류기문*(청주대), 고원률(고려대)	9
2-7 A functional equation related to homogeneous polynomials 박원길*(국가수리과학연구소), 배재형(경희대)	10
2-8 Generalized Hyers-Ulam stability for general Cauchy-Jensen additive mappings 전길웅(충남대), 이주리*(충남대)	10
2-9 On the generalized stability and asymptotic behavior of quadratic mappings 김학만(충남대), 손은영*(충남대)	10
2-10 On the stability of a modified Jensen type cubic mapping 김학만(충남대), 손지애*(충남대)	11
2-11 On the Solution and Stability of generalized exponential functional equations 이영환*(대전대), 김광휘(강남대)	11

20008년도 연구발표회

호서대학교

May 24, 2008 (Saturday)

(* : 발표자)

초청강연

IN-1 조용승(국가수리과학연구소) : Future Prospects of the National Institute for Mathematical Sciences.

국가수리과학연구소의 목표와 수학-과학-기술-산업에서 역할과, 향후
전망.

제1 발표장

1-1 장이채(건국대)*, 김태균(강원대) : Some characterizations of the q -transfer operators

Throughout this paper $\mathbb{Z}_p$, $\mathbb{Q}_p$ and $\mathbb{C}_p$ will, respectively, denote the ring of p -adic rational integers, the field of p -adic rational numbers and the completion of algebraic closure of $\mathbb{Q}_p$. Let v_p be the normalized exponential valuation of $\mathbb{C}_p$ with $|p|_p = p^{-v_p(p)} = p^{-1}$. When one talks of q -extension, q is variously considered as an indeterminate, a complex number $q \in \mathbb{C}$, or a p -adic number $q \in \mathbb{C}_p$. If $q \in \mathbb{C}$, one normally assumes $|q| < 1$. If $q \in \mathbb{C}_p$, then we assume $|q - 1|_p < 1$.

Let d be a fixed positive odd integer and let p be a fixed odd prime number. We now set

$$\begin{aligned} X &= \varprojlim_N \mathbb{Z}/dp^N\mathbb{Z}, \\ X^* &= \bigcup_{\substack{0 < a < dp \\ (a, p) = 1}} a + dp\mathbb{Z}_p, \\ a + dp^N\mathbb{Z}_p &= \{x \in X \mid x \equiv a \pmod{p^N}\}, \end{aligned}$$

where $a \in \mathbb{Z}$ lies in $0 \leq a < dp^N$.

The integral of f on $\mathbb{Z}_p$ will be defined as the limit ($n \rightarrow \infty$) of those sums, when it exists. The fermionic p -adic q -integral of a function $f \in UD(\mathbb{Z}_p)$ is defined by

$$I_{-q}(f) = \int_X f(x) d\mu_{-q}(x) = \int_{\mathbb{Z}_p} f(x) d\mu_{-q}(x) = \lim_{N \rightarrow \infty} \frac{1}{[dp^N]_{-q}} \sum_{x=0}^{dp^N-1} f(x)(-q)^x.$$

In previous paper, we constructed the q -extension of Euler polynomials by using p -adic q -integral on $\mathbb{Z}_p$ as follows:

$$E_n(x : q) = \int_{\mathbb{Z}_p} [t + x]_q^n d\mu_{-q}(t), \quad x \in \mathbb{Z}_+, \quad .$$

Theorem The eigenvalues of the p -adic q -transfer operator are the q -Euler polynomials, and are associated with the eigenvalues $\frac{1}{[p]_q^n}$. That is,

$$(L_{p,q} E_n)(x : q) = \frac{1}{[p]_q^n} E_n(x : q),$$

where $E_n(x : q)$ are q -Euler polynomials.

1-2 안재만(공주대) : The degree-complexity of the defining ideal of a smooth integral curve

Let I be the defining ideal of a non-degenerate smooth integral curve of degree d and of genus g in $\mathbb{P}^n$ where $n \geq 3$. The degree-complexity of I with respect to a term order τ is the maximum degree in a reduced Gröbner bases of I , and is exactly the highest degree of a minimal generator of $\text{ini}_\tau(I)$. For the degree lexicographic order, we show that the degree-complexity of I in generic coordinates is $1 + \binom{d-1}{2} - g$ with the exception of two cases: (1) a rational normal curve in $\mathbb{P}^3$ and (2) an elliptic curve of degree 4 in $\mathbb{P}^3$, where the degree-complexities are 3 and 4 respectively. Additionally if $X \subset \mathbb{P}^n$ is a non-degenerate integral scheme then we show that, for the degree lexicographic order, the degree-complexity of X in generic coordinates does not be changed by an isomorphic projection of X from a general point.

1-3 오세권(충남대), 현선화*(충남대) : Lie bialgebra arising from Poisson bialgebra $U(\mathfrak{sp}_4)^\circ$

Let $U(\mathfrak{sp}_4)$ be the universal enveloping algebra of the symplectic Lie algebra $\mathfrak{sp}_4$. It is known that the restricted dual $U(\mathfrak{sp}_4)^\circ$ becomes a Poisson Hopf algebra with the Sklyanin Poisson bracket determined by the standard classical r-matrix. Here we give an example that is a Lie bialgebra obtained by a Poisson sub-bialgebra of $U(\mathfrak{sp}_4)^\circ$.

1-4 임은혁*(단국대), 이민영(단국대) : Chracterization of Gamma Dstribution by Idepend Property

Let $X_1, X_2, \dots, X_n$ be nondegenerate and positive independent identically distributed(i.i.d.) random variables with common absolutely continues distribution function $F(x)$ and $E(X^2) < \infty$. The random variables $\sum_{k=1}^n X_k$ and $X_1 \cdot X_2 / (\sum_{k=1}^n X_k)^2$ are independent for $n \geq 2$ if and only if $X_1, X_2, \dots, X_n$ have gamma distribution.

1-5 유천성(한남대) : Numerical verification of solutions for some unilateral boundary value problems for second order equations

In this talk we describe a numerical method to verify the existence of solutions for a unilateral boundary value problems for second order equations. It is based on Nakao's method by using finite element approximation and its explicit error estimates for the problem. Using the Riesz present theory in Hilbert space, we first transform the iterative procedure of variational inequalities into a fixed point form. Then, using the Schauder fixed point theory, we construct a high efficiency numerical verification method that through numerical computation generates a bounded, closed, convex set in which includes the approximate solution. Finally, a numerical example is illustrated.

1-6 박영자(호서대) : An Extremal function for Sobolev trace inequality

We explain how an extremal function for the Sobolev trace inequality might be conjectured. We prove that this function is indeed an actual minimizer when we consider the space of functions which share values on the boundary with the conjectured function.

1-7 김영익(단국대) : Asymptotic Error Constants of the k -fold Pseudo-Cauchy's Method for a Simple Zero

The k -fold pseudo-Cauchy's method of order $k + 3$ is proposed from the classical Cauchy's method defined by an iteration

$$x_{n+1} = x_n - \frac{f'(x_n)}{f''(x_n)} \cdot \left(1 - \sqrt{1 - \frac{2f(x_n)f''(x_n)}{f'(x_n)^2}}\right).$$

The convergence behavior of the asymptotic error constant is investigated near the corresponding simple zero. A root-finding algorithm with the k -fold pseudo-Cauchy's method is described and computational examples have successfully confirmed the current analysis.

1-8 박희철(단국대) : Derivation of the pseudo-parabolic equation for thin-film capacitances via homogenization

Models for distributed capacitance in a thin film are derived in the form of a system of local RC diffusion equations coupled by a global elliptic equation. Such models contain the local geometry of the distributed capacitance on which charge is stored and the exchange of current flux on its interface with the medium. Certain singular limits are characterized, and the resulting degenerate initial-boundary-value problems are shown to be well posed.

1-9 박희철(단국대), 권은정*(단국대) : Analytic functions on surfaces embedded in Quaternions

Contour integrals on Quaternions which generalize complex integration are discussed. Some basic notions will be carefully introduced such as S -analytic functions on a given surface imbedded in Quaternions. The Cauchy theorem for S -analytic functions on a simple surface parallel to t -axis:

$$\int_C d\mathbf{z} \cdot f(\mathbf{z}) = \mathbf{0}$$

is proved. This new theorem generalizes the classical Cauchy theorem since the complex plane can be regarded as a simple surface parallel to t -axis imbedded in Quaternions.

1-10 서종진*(한남대), 김주필(한남대), 최은미(한남대), 김상배(한남대), 유천성(한남대) :
대학 교양수학 교육의 효율성에 관한 소고

공학이나 자연과학을 전공하는 대부분의 대학생들은 대학 교양수학 강좌를 1학기 또는 2학기를 필수적으로 수강하여야 한다. 이는 수학이 그 분야에서 중요한 역할을 하고 있기 때문이다. 그러므로 각 대학의 대학 교양수학 강좌에서는, 각 전공에서 필요로 하는 수학 내용을 선별하여 교재를 구성하고 교수하여 왔다. 이러한 노력은, 대학생들이 각 전공과목에서 수학을 활용할 수 있는 능력을 기를 수 있도록 하여 왔으며, 수학을 필요로 하는 전공과목을 수행하는데 어느 정도의 어려움을 해소시켜 왔다고 할 수 있다. 그러나 현재, 대학 신입생들의 기초수학 능력 부족 현상은 기존의 대학 교양수학 내용과 교수-학습의 효율성에 대한 재고를 제공하고 있다. 그러므로 본고에서는, 대학 신입생들의 수학 학습 상황과 각 전공과목에서 사용되는 기초수학 내용을 고려하여 대학 교양수학 교육 내용의 구성과 교수-학습에서의 효율적인 방안을 모색하여 보았다.

* 이 논문은 2008 정부(교육과학기술부)의 재원으로 한국학술진흥재단의 지원을 받아 수행된 연구임(학술진흥재단 2005년 이공계 교육과정 개발 연구지원 사업 KRF-2005-082-C00008).

제2 발표장

2-1 최규홍*(인하대), 정택선(군산대) : Topological Method and its Application to Dirichlet Boundary Value Problems

Let L be the wave operator in $\mathbb{R}^2$, $Lu = u_{tt} - u_{xx}$. We investigate the existence of solutions $u(x, t)$ for the hyperbolic system with Dirichlet boundary condition

$$\begin{aligned}
 (1) \quad & L\xi = f(x, t, \xi, \eta) \quad \text{in} \quad \left(-\frac{\pi}{2}, \frac{\pi}{2}\right) \times \mathbb{R}, \\
 & L\eta = g(x, t, \xi, \eta) \quad \text{in} \quad \left(-\frac{\pi}{2}, \frac{\pi}{2}\right) \times \mathbb{R}, \\
 & \xi\left(\pm\frac{\pi}{2}, t\right) = 0, \quad \xi(x, t + \pi) = \xi(x, t) = \xi(-x, t), \\
 & \eta\left(\pm\frac{\pi}{2}, t\right) = 0, \quad \eta(x, t + \pi) = \eta(x, t) = \eta(-x, t).
 \end{aligned}$$

To show the existence of solutions for a equation or a system with Dirichlet boundary condition, we use several topological methods. Here we study the existence of solutions for a equation or a system with jumping nonlinearity.

The following type nonlinear equation with Dirichlet boundary condition was studied by many authors.

$$\begin{aligned}
 (2) \quad & u_{tt} - u_{xx} = b[(u + 2)^+ - 2] \quad \text{in} \quad \left(-\frac{\pi}{2}, \frac{\pi}{2}\right) \times \mathbb{R}, \\
 & u\left(\pm\frac{\pi}{2}, t\right) = 0, \quad u(x, t + \pi) = u(x, t) = u(-x, t).
 \end{aligned}$$

Lazer and McKenna point out that this kind of nonlinearity $b[(u + 2)^+ - 2]$ can furnish a model to study traveling waves in suspension bridges. So the nonlinear equation with jumping nonlinearity have been extensively studied by many authors. For fourth elliptic equation Tarantello, Micheletti and Pistoia proved the existence of nontrivial solutions used degree theory and critical points theory separately. For one-dimensional case Lazer and McKenna proved the existence of nontrivial solution by the global bifurcation method. For this jumping nonlinearity we are interest in the multiple nontrivial solutions of the equation. Here we used variational reduction method to find the nontrivial solutions of problem (1.1).

2-2 김원규*(충북대), 금상호(충북대) : On a non-compact minimax theorem using weak concavelike condition

In this paper, we first introduce the weak concavelike condition which generalizes the concavelike concept due to Fan, and using this concept, we will prove a new non-compact minimax theorem with a Gordan type alternative theorem by applying the separation theorem for convex sets. Next we give some examples which shows that the convexity and concavity assumptions on Kneser's minimax theorem can not be relaxed with the quasi-convex and quasi-concave conditions, and also is suitable for our theorem.

Main result of this paper is as follow:

Theorem. Let X be a topological space, D a non-empty compact subset of X , and Y be a non-empty set. Let $f : X \times Y \rightarrow \mathbb{R}$ be a function satisfying the following

- (1) for each $y \in Y$, the function $x \mapsto f(x, y)$ is upper semicontinuous and weak concavelike on X ;
- (2) for each $x \in X$, the function $y \mapsto f(x, y)$ is convexlike on Y ;
- (3) the inequality

$$\inf_{y \in Y} \sup_{x \in X \setminus D} f(x, y) < \inf_{y \in Y} \sup_{x \in X} f(x, y)$$

holds.

Then we have

$$\sup_{x \in X} \inf_{y \in Y} f(x, y) = \inf_{y \in Y} \max_{x \in X} f(x, y).$$

2-3 Le Huy Tien(충남대) : Exponential dichotomy, structural stability and shadowing of nonautonomous linear difference equations

We study relation between exponential dichotomy, structural stability and shadowing of nonautonomous linear difference equations. It is proved that exponentially dichotomous systems are structurally stable and have shadowing property. The main tool is Perron's theorem that characterizes exponential dichotomy in term of the existence of the bounded solution of the nonhomogeneous equation.

2-4 구세현(충남대) : Characterizations on 2-isometries

We consider the notion of 2-isometry which is suitable to represent the concept of area preserving mapping in linear 2-normed spaces and investigate the properties of the 2-isometry. We also show that the Riesz theorem holds when X is a linear 2-normed space.

2-5 구남집(충남대), 강보원*(충남대) : h -stability of linear difference equations via n_∞ -quasisimilarity

In this talk, we introduce the concept of n_∞ -quasisimilarity and study h -stability for linear difference systems by using the notion of n_∞ -quasisimilarity and discrete Gronwall's inequality.

2-6 류기문*(청주대), 고원률(고려대) : Positive coexistence of a Lotka-Volterra type simple food-chain model

In this talk, we are interested in the following Lotka-Volterra type simple food chain model:

$$\begin{cases} u_t - d_1 \Delta u = u(a_1 - b_{11}u - b_{12}v) \\ v_t - d_2 \Delta v = v(a_2 + b_{21}u - b_{22}v - b_{23}w) \\ w_t - d_3 \Delta w = w(a_3 + b_{32}v - b_{33}w) \\ (u, v, w) = (0, 0, 0) \\ (u(x, 0), v(x, 0), w(x, 0)) = (\tilde{u}(x), \tilde{v}(x), \tilde{w}(x)) \end{cases} \begin{array}{l} \text{in } \Omega \times [0, T), \\ \text{on } \partial\Omega \times [0, T), \\ \text{in } \bar{\Omega} \end{array}$$

in a bounded domain Ω of $\mathbf{R}^n$ with smooth boundary $\partial\Omega$ and $T \in (0, \infty)$. Here the constants d_i, b_{ij} with $(i, j) \neq (1, 3), (3, 1)$ are positive and a_i may change the signs for $i, j = 1, 2, 3$.

We investigate the positive coexistence of the steady states to the model and give some results for the extinction of species under certain assumptions which can be interpreted as *Domino effect* and *Biological control*. The methods of a decoupling operator and the fixed point index theory on a positive cone are used as well as the comparison argument. Numerical evidences for our results also are provided.

- 2-7 박원길*(국가수리과학연구소), 배재형(경희대) : A functional equation related to homogeneous polynomials
-

In this paper, we obtain the general solution and the stability of the cubic functional equation $f(2x+y, 2z+w) + f(2x-y, 2z-w) = 2f(x+y, z+w) + 2f(x-y, z-w) + 12f(x, z)$. The cubic form $f(x, y) = ax^3 + bx^2y + cxy^2 + dy^3$ is a solution of the above functional equation.

- 2-8 전길웅(충남대), 이주리*(충남대) : Generalized Hyers–Ulam stability for general Cauchy–Jensen additive mappings
-

In 1940 S.M. Ulam proposed the famous Ulam stability problem. In 1941 D.H. Hyers solved the well-known Ulam stability problem for additive mappings subject to the Hyers condition on approximately additive mappings. The first author of this paper investigated the Hyers–Ulam stability of Cauchy and Cauchy–Jensen type additive mappings. In this paper we generalize results obtained for Cauchy–Jensen type mappings and establish new theorems about the Ulam stability of general Cauchy–Jensen additive mappings.

- 2-9 김학만(충남대), 손은영*(충남대) : On the generalized stability and asymptotic behavior of quadratic mappings
-

Let E_1 and E_2 be vector spaces. In this talk, we prove that a mapping $f : E_1 \rightarrow E_2$ satisfies the functional equation

$$\sum_{1 \leq i < j \leq d+1} \left(\bigoplus_{x_j} f(x_i) \right) = 2d \sum_{i=1}^{d+1} f(x_i)$$

for all $(d+1)$ -variables $x_1, \dots, x_{d+1} \in E_1$, where $d \geq 1$ is a natural number. if and only if the mapping f is a quadratic mappings.

Moreover, we extend the stability of quadratic mappings to the stability of general quadratic mappings with several variables, and then obtain an improved asymptotic property of quadratic mappings on restricted domains.

- 2-10 김학만(충남대), 손지애*(충남대) : On the stability of a modified Jensen type cubic mapping
-

In this talk, we introduce a Jensen type cubic functional equation

$$\begin{aligned} f\left(\frac{3x+y}{2}\right) + f\left(\frac{x+3y}{2}\right) \\ = 12f\left(\frac{x+y}{2}\right) + 2f(x) + 2f(y), \end{aligned}$$

and then investigate the generalized Hyers–Ulam stability problem for the equation.

- 2-11 이영환*(대전대), 김광휘(강남대) : On the Solution and Stability of generalized exponential functional equations
-

In this paper we generalize the superstability of the exponential functional equation proved by J. Baker et al., that is, we solve generalized exponential functional equations of the following form :

$$f(x+y) = E(x,y)f(x)f(y)$$

where $E(x,y)$ is an exponential type coordinator and obtain the superstability of these equations. Also we generalize the stability of generalized exponential functional equations in the spirit of R. Ger of the following form :

$$\left| \frac{f(x+y)}{E(x,y)f(x)f(y)} - 1 \right| \leq \delta.$$

Key words and phrases: Exponential functional equation, Stability of functional equation, Superstability, Solution of functional equation.