2017년 강원경기수학회-충청수학회 공동 학술회의 및 정기총회

- 일시 : 2017년 6월 8일–10일
- 장소 : 단국대학교 천안캠퍼스 산학협력관
- 주최 : 강원경기수학회 및 충청수학회
- 주관 : 고등과학원, 단국대학교
- 후원 : 대한수학회

강원경기수학회 및 충청수학회

- MEMO -

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- 4차 산업 혁명과 수학계의 대응 ..... 자연과학대 1호관 211호
- 접수 및 등록 ..... 산학협력관 1층 로비
- 개회식, 수상강연 및 대중강연 ..... 산학협력관 112호
- 대수학 및 이산수학 분과 (I) ..... 산학협력관 113호
- 해석학 I 분과 (II) ..... 산학협력관 114호
- 해석학 II 분과 (V) ..... 산학협력관 304호
- 기하학 및 위상수학 분과 (III) ..... 산학협력관 301호
- 응용수학 분과 (IV) ..... 산학협력관 302호
- 수학교육 분과 (V) ..... 산학협력관 304호
- 신진수학자 분과 (VI) ..... 산학협력관 305호
- 강원경기수학회 정기총회 ..... 산학협력관 113호
- 충청수학회 정기총회 ..... 산학협력관 112호
- 산업수학 특별 강연 ..... 산학협력관 114호
- 휴게실 1 ..... 산학협력관 212호
- 휴게실 2 ..... 산학협력관 205호
- 점심 및 만찬 ..... 교직원식당

단국대 천안 캠퍼스 지도



** 산학협력관은 단국대학교 천안캠퍼스 정문 좌측에 위치하고 있습니다 **

2017년 강원경기수학회-충청수학회

공동 학술회의 및 정기총회 일정

1. 일시 : 2017년 6월 8일–10일

2. 장소 : 단국대학교 천안캠퍼스 산학협력관

3. 세부일정

- 2017년 6월 8일 -

- 15:00 – 18:00 4차 산업혁명과 수학계 대응전략 간담회 .....
  (지부 회장단, 대한수학회 회장단, NRF 자연과학단장, NIMS 소장 외)

- 2017년 6월 9일 -

- 09:00 – 16:40 .....접수 및 등록
- 09:30 – 09:50 .....분과발표 N-1
- 09:50 – 10:10 .....분과발표 N-2
- 10:10 – 10:30 .....분과발표 N-3
- 10:30 – 10:40 .....휴식
- 10:40 – 11:00 ..... 개회식
- 11:00 – 11:25 .....2016년 KKMS 학술상 수상 강연 (김광휘 교수, 강남대)
- 11:25 – 11:50 .....2016년 CCMS 학술상 수상 강연 (성수학 교수, 배재대)
- 11:50 – 12:00 ..... 기념사진 촬영
- 12:00 – 13:00 .....점심식사
- 13:00 – 13:20 .....분과발표 N-4
- 13:20 – 13:40 .....분과발표 N-5
- 13:40 – 14:00 .....분과발표 N-6
- 14:00 – 14:20 .....휴식
- 14:20 – 14:40 .....분과발표 N-7
- 14:40 – 15:00 .....분과발표 N-8
- 15:00 – 15:20 .....분과발표 N-9
- 15:20 – 15:30 .....휴식
- 15:30 – 16:10 ..... 대중강연 I (이상구 교수, 성균관대)

- 16:10 – 16:50 ..... 대중강연 II (신진우 교수, KAIST)
- 16:50 – 17:00 ..... 한국연구재단 산업수학 신규사업 설명 (이용훈 단장)
- 17:00 – 17:10 ..... 휴식 및 이동
- 17:10 – 17:40 ..... 학회별 정기총회
- 18:00 – ..... 만찬

- 2017년 6월 10일 -

- 10:00 – 10:40 ..... 산업수학 특별 강연 I (김영록 교수, 한국외대)
- 10:40 – 11:20 ..... 산업수학 특별 강연 II (서진근 교수, 연세대)
- 11:20 – 12:00 ..... 산업수학 특별 강연 III (조진환 센터장, NIMS)

특별 강연 일정표

- 2017년 6월 9일 -

(산학협력관 112호)

- 11:00 – 11:25 ..... 2016년 KKMS 학술상 수상 강연 (김광휘 교수, 강남대)
  (좌장) 강원경기수학회 총무이사
- 11:25 – 11:50 ..... 2016년 CCMS 학술상 수상 강연 (성수학 교수, 배재대)
  (좌장) 충청수학회 총무이사
- 15:30 – 16:10 ..... 대중강연 I (이상구 교수, 성균관대)
  (좌장) 충청수학회 회장
- 16:10 – 16:50 ..... 대중강연 II (신진우 교수, KAIST)
  (좌장) 강원경기수학회 회장
- 16:50 – 17:00 ..... NRF 산업수학 신규사업 설명 (이용훈 자연과학단장)
  (좌장) 충청수학회 회장

- 2017년 6월 10일 -

(산학협력관 114호)

- 10:00 – 10:40 ..... 산업수학 특별 강연 I (김영록 교수, 한국외대)
- 10:40 – 11:20 ..... 산업수학 특별 강연 II (서진근 교수, 연세대)
- 11:20 – 12:00 ..... 산업수학 특별 강연 III (조진환 센터장, NIMS)
  (좌장) 충청수학회 산업수학담당이사

- MEMO -

분과 발표 일정표 I

교시	시간	분과 I 대수학및이산수학 (산학협력관 113호)	분과 II 해석학 I (산학협력관 114호)	분과 III 기하학및위상수학 (산학협력관 301호)
	(좌장)	(박상돈, 한경대)	(이상훈, 충남대)	(오주미, 성균관대)
1	09:30 – 09:50	박영호	구윤회	김상진
2	09:50 – 10:10	가동석	정택선	정우철
3	10:10 – 10:30	전재관	김대욱	신보미
	(좌장)	(이기석, 교원대)	(박춘길, 한양대)	(강보원, 충남대)
4	13:00 – 13:20	Mojallal	김병수	Nguyen
5	13:20 – 13:40	정지환	박진석	윤수지
6	13:40 – 14:00	최환혁	유현재	오윤명
	(좌장)	(안재현, 충남대)	(김도형, 단국대)	(김병학, 경희대)
7	14:20 – 14:40	이기석	허인조	강보원
8	14:40 – 15:00	강순이	박춘길	이현진
9	15:00 – 15:20	서승현	최병진	정승달

분과 발표 일정표 II

교시	시간	IV 응용수학 (산학협력관 302호)	V 수학교육및해석학II (산학협력관 304호)	VI 신진수학자 (산학협력관 305호)
	(좌장)	(김경수, 경희대)	(표재홍, 강원대)	(동미화, 충남대)
1	09:30 – 09:50	ϕ	ϕ	ϕ
2	09:50 – 10:10	한성휴	민숙	이현희
3	10:10 – 10:30	강준혁	백선민	황진미
	(좌장)	(유일, 연세대)	(노재옥, 한림대)	(이현희, 충남대)
4	13:00 – 13:20	이민구	김선광	동미화
5	13:20 – 13:40	표재홍	최종근	김광호
6	13:40 – 14:00	금영희	마용기	황진아
	(좌장)	(박종안, 강원대)	(마용기, 공주대)	(이정례, 대진대)
7	14:20 – 14:40	김광연	조동현	서영주
8	14:40 – 15:00	이윤희	신수연	심은화
9	15:00 – 15:20	김준기	ϕ	박윤경

(ϕ : 배정없음)

2017년 강원경기수학회-충청수학회
학술발표회 논문 초록

2017년 6월 9일

강원경기수학회 및 충청수학회

S. Special Lectures
(산학협력관 112호)

S-1 (11:00 – 11:25)

Hyperstability and stability of a functional equation with four variables

Kim, Gwang Hui
Kangnam University

The superstability of the cosine functional equation (d'Alembert), Wilson equation, trigonometric equation $f(x+y) \pm f(x-y) = 2f(x)g(y)$, and the sine functional equation $f(\frac{x+y}{2})^2 \pm f(\frac{x-y}{2})^2 = f(x)f(y)$ in two vaiables is investigated.

As extension to four variables, we considered stability of the equation $f(pr, qs) + f(ps, qr) = f(p, q)f(r, s)$, $f(pr, qs) + f(ps, qr) = \theta(pq, rs)f(p, q)\, f(r, s) : \theta$ a cocycle, $f(pr, qs) + f(ps, qr) = \theta(p, q, r, s)f(p, q)\, f(r, s) : \theta$ a mapping, which is related to distance measure. We can consider the logarithm-type functional equation $f(pr, qs) + f(ps, qr) = 2f(p, q) + 2f(r, s)$.

In this paper, we investigate the hyperstability and stability of the above functional equation as follows : if f satisfies a stability inequality for the above equation then it is also a solution of this equation or we can find an another solution of it which has the small error bound.

S-2 (11:25 – 11:50)

Law of Large Numbers

Soo Hak Sung
Baejae University

In this talk, we discuss the law of large numbers. It states that the sample mean converges to the population mean as the sample size increases.

S-3 (15:30 – 16:10)

Innovative Teaching of College Math and Math Lab (Sage를 활용한 대학수학 실습 운영 방안 및 사례)

Sang-Gu Lee
Sungkyunkwan University

In this talk, we introduce recently developed interactive digital Mathematics textbook. Our digital textbook includes all available materials such as PDF e-book, web contents, video clips of lectures, interactive labs. Using this mathematics digital textbook, students can freely use any mobile devices to access diverse learning materials, lessons, and hands-on exercises without any limitations. Also, times saved in the computation, coding, and typing process can be used to have more discussions for deeper understanding of mathematical concepts. We will share ideas on Mathematics Lab and Evaluation in this new learning environment with our interactive digital Mathematics textbook.

Refer :

1. (Free Textbook -영문) http://goo.gl/t3JcNP
2. (Free Textbook - 한글) http://matrix.skku.ac.kr/2015-Album/BigBook-LinearAlgebra-2015.pdf
3. Calculus LAB : http://matrix.skku.ac.kr/Cal-Book/
4. LA Lab : http://matrix.skku.ac.kr/LA/ or http://matrix.skku.ac.kr/LA-K/

S-4 (16:10 – 16:50)

Mathematics for machine learning

Jinwoo Shin
KAIST

In this talk, I first overview several types of mathematical questions/results with concrete examples, which have been addressed in the machine learning literature. Then, I will provide several open mathematical questions, in particular, for deep learning.

S-5 (10:00 – 10:40)

지능정보사회에 바람직한 산업수학 교육과정

Young Rok Kim
Hankuk University of Foreign Studies

4차 산업혁명 시대에 필요한 최소한의 소양으로서 코딩 능력을 꼽을 수 있다. 지능 정보화 시대의 화두는 얼마나 빠른 시간 안에 새로운 대상을 배울 수 있는 학습능력이라고 할 수 있다. 새로운 직업군의 탄생과 기존에 존재하지 않았던 산업의 출현으로 인하여 생겨난 환경에 적응할 수 있는 인재의 양성을 필요로 하고 있다. 국내에서 산업수학이 실질적인 성과를 도출하기 위해서는 장기적인 안목에서의 인재서성과 그에 따르는 교육과정의 개편이 전제되어야 한다. 기존의 도제식 교육 과정은 경쟁력을 잃어 가고 있으며 새로운 인재의 양성에 있어서도 낡은 틀을 제공할 뿐이다. 이에 대학에서의 전면적인 커리큘럼 개편이 바람직하나 교육의 특성상 점진적인 변화를 위한 대안을 제시하도록 한다. 수학의 특성상 학부교육의 특성은 전공의 필요한 이론 과목들을 이수하는 것으로 되어 있다. 이는 대학원 진학을 위한 학생들을 위해서는 바람직할지 모르나 대학 졸업 후 취업을 원하는 학생들의 니즈와는 상당한 거리가 있다. 수리계산과 수리 모델링의 전공트랙을 신설하거나 산업수학의 입문과 같은 과목을 개설할 필요가 있다. 또한 인턴과 같은 실습체험을 통해 구체적인 문제 해결의 경험을 가질 수 있도록 지도 할 필요가 있다. 단, 수학전공자로서의 강점인 생각의 습관, 엄격한 사고, 신중한 추론에 대한 자신을 겸비해야 한다. 수학과 대학원에서의 석사과정은 박사과정을 위한 전단계로 치부되고 일부 연구 중심 대학에서는 박사과정 중 탈락자에게 석사학위를 주는 등 가볍게 취급되고 있는 것이 현실이다. 그러나 산업수학 분야에서 새로운 전문이학석사 프로그램이 새로운 대안으로 주목 받고 있다. 이는 산업계에서 필요로 하는 맞춤형인재를 양성하는 것으로 기본적으로는 과학 계산, 수학적 모델링, 커뮤니케이션 교육, 실습과 프로젝트 수업 등으로 정리할 수 있다.

S-6 (10:40 – 11:20)

인공지능과 계산과학

Jin Keun Seo
Yonsei University

최근 수년간 딥러닝기술의 획기적인 개선은 고성능 GPU 컴퓨팅과 빅데이터의 분석/활용 기술의 급속한 발전, 그리고 구글, 페이스북, IBM 등의 적극적인 투자 때문인 듯하다. 의료영상 판독에서 딥러닝 기술은 Training data가 쌓여감에 따라 정확도가 급속히 향상되어가고 있어, 전 세계적으로 많은 인공지능기업들이 의료분야에 사업화를 시도하고

있다. 딥러닝에 관한 수많은 언론보도와 논문에도 불구하고, 의료현장에서는 컴퓨터 자동 진단 시스템처럼 아주 제한적인 비즈니스 활용에만 그칠 것이라 판단하는 의사가 많다. 이러한 불신은 지난 20년간 세계적인 과학자나 공학자들의 수많은 연구 결과들이 실제 의료현장에서 비즈니스 모델로 성공한 사례가 드물기 때문이다. 1990년대 잠깐 각광을 받은 인공지능이 급격히 열기가 식은 이유는 실전적인 개발능력을 갖추지 못한 채 연구논문과 코딩에만 집중했기 때문이다. 학문적인 신뢰를 얻기 위해서라도 실전적인 연구는 필수적이다. 본 강연은 실전적인 비즈니스 모델을 바탕으로하는 계산과학 개념을 설명하는데 중점을 두고자 한다.

S-7 (11:20 – 12:00)

산업수학 문제 발굴과 해결:
산업수학혁신센터 일 년의 성과

Jin-Hwan Cho
National Istitute of Mathematical Sciences

2014년 서울 세계수학자대회의 성공적인 개최 이후 한국 수학계의 새로운 모멘텀을 산업수학에서 찾으려는 시도가 있었다. 2015년부터 18개월 동안 국가수리과학연구소 주관으로 진행된 산업수학 점화프로그램에는 국내 21개 대학들이 참여해 다양한 관점과 방법으로 산업수학의 가능성을 모색하였다. 2016년 3월 국가수리과학연구소는 판교 테크노밸리에 산업수학혁신센터를 개소하고, 산업계와 수학계가 만나 산업수학을 통해 새로운 가치를 창출하기 위한 여러 가지 일들을 수행하고 있다. 이 강연에서는 스타트업의 연구개발 지원을 목적으로 출발한 산업수학혁신센터의 추진 배경과 운영 모델에 대해 설명하고, 지난 일년간 산업수학 문제 발굴과 해결 과정에서 나타난 성공 사례들과 애로점들을 소개하고자 한다.

I. Algebra and Discrete Mathematics

(산학협력관 113호)

I-1 (09:30 – 09:50)

Codes over rings

Young Ho Park

Kangwon National University

Codes, linear or nonlinear, were originally defined over the field of two elements. Later some *nonlinear* binary codes were shown to be Gray images of "linear" codes over $\mathbb{Z}_4$. Since then, codes over rings have been studied by many authors. We introduce the "right" rings for coding theory to use the powerful machinery of algebraic codes. We present some results on codes over $\mathbb{Z}_m$. We also explain the p-adic codes and their projections to $\mathbb{Z}_p$, and their generalization to q-adic codes, if time permits.

I-2 (09:50 – 10:10)

Weight enumerators of linear codes from defining sets

Dongseok Ka

Chungnam National University

Jaehyun Ahn

Chungnam National University

Recently, linear codes constructed from defining sets have been studied widely and they have many applications. In this talk, we compute weight enuerators punctured linear codes of $\mathcal{C}_D$. This talk is based on a joint work with J.Ahn.

I-3 (10:10 – 10:30)

Invariants of deformations of quotient surface singularities

Jaekwan Jeon

Chungnam National University

Dongsoo Shin

Chungnam National University

Byoung Cheon Han

Chungnam National University

For a quotient surface singularity X, there is an one-to-one correspondence between the irreducible components of the reduced base space of the versal deformation Def(X) and certain partial resolutions, called *P-resolutions* of X. We first find all P-resolutions of quotient surface singularities. Then we compute the dimensions and Milnor numbers of the corresponding irreducible components. Furthermore, we realize Milnor fibers corresponding to P-resolutions as complements of certain special divisors (called *compactifying divisors*) in certain rational surfaces by using the minimal model program of 3-folds. This is part of the master's thesis of Byoungcheon Han and Jaekwan Jeon at Chungnam National University.

I-4 (13:00 – 13:20)

The spectral properties of Riordan graphs

Seyed Ahmad Mojallal
Applied Algebra and Optimization Research Center, Sungkyunkwan University

Gi-Sang Cheon
Sungkyunkwan University

Riordan arrays are infinite lower triangular matrices defined by two generating functions [L. V. Shapiro, S. Getu, W. J. Woan, L. Woodson, The Riordan group, Discrete Appl. Math. 34 (1991) 229–239]. Considering an $n \times n$ Riordan matrix in modulo two, we define Riordan graph RG_n of order n. In this talk, we study some spectral invariants of Riordan graphs such as the adjacency spectrum, Laplacian and signless Laplacian spectrums, nullity, inertia and determinant of Riordan graphs. Moreover, we show that our results for Riordan graphs are better than previous results for general graphs.

I-5 (13:20 – 13:40)

Horizontal and Vertical Formulas for Exponential Riordan Matrix

Ji-Hwan Jung
Sungkyunkwan University

Gi-Sang Cheon
Sungkyunkwan University

Paul Barry
School of Science, Waterford Institute of Technology

In this talk, we show that an infinite lower triangular matrix $R = [r_{ij}]_{i,j\in\mathbb{N}_0}$ is an exponential Riordan matrix $R = \mathcal{E}(g, f)$ given by $\sum_{i\geq j} r_{ij} z^i/i! = g f^j/j!$ if and only if there exist both horizontal pair $\{h_n; \tilde{h}_n\}_{n\geq 0}$ and vertical pair $\{v_n; \tilde{v}_n\}_{n\geq 0}$ of the sequences

such that

$$r_{n+1,k} = \tilde{h}_0 r_{n,k-1} + \sum_{j=0}^{n-k} \left((k+1)^{\overline{j}} h_j + k^{\overline{j+1}} \tilde{h}_{j+1} \right) r_{n,k+j}, \quad (n \geq k \geq 0)$$

and

$$r_{n,k-1} = \tilde{v}_0 r_{n+1,k} + \sum_{j=0}^{n-k} \left(n^{\underline{j}} v_j + n^{\underline{j+1}} \tilde{v}_{j+1} \right) r_{n-j,k}, \quad (n \geq k \geq 1)$$

where $x^{\overline{n}}$ and $x^{\underline{n}}$ are the rising and falling factorials of $x \geq 0$ defined by

$$x^{\overline{n}} = x(x+1)\cdots(x+n-1) \text{ and } x^{\underline{n}} = x(x-1)\cdots(x-n+1), \quad n \geq 1$$

with $x^{\overline{0}} = x^{\underline{0}} = 1$. Applying this result, we obtain that if the horizontal and vertical pairs of an exponential Riordan matrix are identical then the matrix is involution. In addition, this concept can be applied to obtain the determinants of the Hessenberg matrices and some conditions for d-orthogonality of the Sheffer polynomial sequences.

I-6 (13:40 – 14:00)

The classification of self-dual codes over Galois rings

Whan-Hyuk Choi
Kangwon Natl' University

We classify the self-dual codes of length 4 over Galois rings $GR(p^2, 1)$, $GR(p, 2)$ and $GR(p^2, 2)$ for all primes p up to equivalence in terms of their automorphism groups and obtain the necessary and sufficient conditions for existence of each classes. We also obtain the number of inequivalent classes for all primes.

I-7 (14:20 – 14:40)

Galois polynomials

Ki-Suk Lee
Korea National University of Education

Ji-Eun Lee
Korea National University of Education

Galois polynomial, $J_{n,H}(x)$ is defined as a generalization of Cyclotomic polynomial, where n is a positive integer and H is a subgroup of the multiplicative group $\mathbb{Z}_n^*$. Galois polynomials have integer coefficients as Cyclotomic polynomials. But Galois polynomials are not always irreducible. Some conditions for the irreducibility of the Galois polynomials are studied.

I-8 (14:40 – 15:00)

On the 2nd order mock theta functions

Soon-Yi Kang
Kangwon National University

We compute shadows of the second order mock theta functions and show that they are essentially same with the shadow of a mock theta function related to the Mathieu moonshine phenomenon. We further survey the second order mock theta functions on their quantum modularity and their behavior in the lower half plane.

I-9 (15:00 – 15:20)

Enumerations of vertices among all rooted ordered trees with levels and degrees

Seunghyun Seo
Kangwon National University

Sen-Peng Eu
National Taiwan Normal University

Heesung Shin
Inha University

In this talk, we enumerate the cardinalities and give bijections for the following four sets of vertices among all rooted ordered trees of a fixed size: (i) all first children of degree k at level ℓ, (ii) all non-first children of degree k at level $\ell-1$, (iii) all leaves having $k-1$ elder siblings at level ℓ, and (iv) all non-leaves of outdegree k at level $\ell-1$. Our results unite and generalize several previous works in the literature.

II. Analysis I

(산학협력관 114호)

II-1 (09:30 – 09:50)

Existence of periodic solutions of abstract neutral functional differential equations with infinite delay

Yoon Hoe Goo

Hanseo University

Dong Man Im

Chongju University

Chun Mi Ryu

Chungnam National University

In this talk, we show a result of existence of periodic solutions for abstract neutral functional differential equations with infinite delay that can be modeled in the form

$$\frac{d}{dt}(x(t) + f(t, x_t)) + Ax(t) = G(t, x_t)$$

where A is the infinitesimal generator of a analytic semigroup of bounded linear operators on a Banach space X and the initial condition x_0 as F and G are continuous functions.

II-2 (09:50 – 10:10)

Infinitely many solutions for a class of the elliptic systems

Tacksun Jung

Kunsan National University

Q-Heung Choi

Inha University

We get a result that shows the existence of infinitely many solutions for a class of the elliptic systems involving subcritical Sobolev exponents nonlinear terms with even functionals on the bounded domain with smooth boundary. We get this result by variational method and critical point theory induced from invariant subspaces and invariant functional.

II-3 (10:10 – 10:30)

On the well-posedness for a Kirchhoff-Carrier system with an internal time-varying delay term

Daewook Kim
Seowon University

In this talk we prove the well-posedness when the special cases between nonlinear forcing term and nonlinear damping term for a Kirchhoff-Carrier system with an internal time-varying delay term. First, we introduce the main theorem and some lemmas. We are mainly interested in the well-posedness result for the relations between p and m in the system. We also use the smallness condition and taking into account the appropriate Lyapunov functional. Finally, we get the general decay rate of the main energy.

II-4 (13:00 – 13:20)

Integral transform and generalized convolution product for functionals on Wiener space

Byoung Soo Kim
Seoul National University of Technology

Il Yoo
Yonsei University

In 1982, Lee defined an integral transform $\mathcal{F}_{\gamma,\eta}$ of analytic functionals on an abstract Wiener space. For certain values of the parameter γ and η and for certain classes of functionals, the Fourier-Wiener transform, the Fourier-Feynman transform, and the Gauss transform are special cases of his integral transform $\mathcal{F}_{\gamma,\eta}$. We introduce a generalized convolution product $(F * G)_{\vec{\alpha},\vec{\beta}}$ for integral transform $\mathcal{F}_{\gamma,\eta}$ for functionals defined on $K[0,T]$. We study some interesting properties of the generalized convolution product. In particular we give a necessary and sufficient conditions for the generalized convolution product to be commutative. We also study an associativity result of the generalized convolution product.

II-5 (13:20 – 13:40)

Refined stability of additive and quadratic functional equations in modular spaces

Jinseok Park
Chungnam National University

Hwan-yong Shin
Chungnam National University

Hark-mahn Kim
Chungnam National University

The purpose of this paper is to obtain refined stability results and alternative stability results for additive and quadratic functional equations using direct method in modular spaces.

II-6 (13:40 – 14:00)

Multi-dimensional orthogonal polynomials and the support of the measure

Hyun Jae Yoo
Hankyong National University

In this talk we discuss the multi-dimensional orthogonal polynomials for probability measures. Our point is to look at the theory by using quantum probability. By introducing the creation, annihilation, and preservation operators (CAP operators), we develop interacting Fock space and thereby the coordinate variables, which are understood as multiplication operators, are decomposed into the sum of CAP operators. We investigate the support of the measure by using the concept of deficiency rank for the Jacobi operators. This is a joint work with Ameur Dhahri and Nobuaki Obata.

II-7 (14:20 – 14:40)

Spectral Theory on Schrödinger operators, Jacobi operators and canonical systems

Injo Hur
UNIST

Some direct and inverse spectral theories for Schrödinger operators and canonical systems will be introduced. In the discussion, so-called Weyl-Titchmarsh m-functions are used as their spectral data. We will then explore two results: the density of the m-functions for Schrödinger operators on all Herglotz functions and no-density of those for discrete Schrödinger operators on Jacobi operators.

II-8 (14:40 – 15:00)

Some additive ρ-functional inequalities and applications

Choonkil Park
Hanyang University

Jung Rye Lee
Daejin University

In this talk, we solve the additive ρ-functional inequalities

$$\|f(x+y+z)-f(x)-f(y)-f(z)\| \leq \left\|\rho\left(2f\left(\frac{x+y}{2}+z\right)-f(x)-f(y)-2f(z)\right)\right\|,$$

where ρ is a fixed complex number with $|\rho|<1$, and

$$\left\|2f\left(\frac{x+y}{2}+z\right)-f(x)-f(y)-2f(z)\right\| \leq \|\rho(f(x+y+z)-f(x)-f(y)-f(z))\|,$$

where ρ is a fixed complex number with $|\rho|<1$.

Furthermore, we prove the Hyers-Ulam stability of the above additive ρ-functional inequalities in complex Banach spaces. This is applied to investigate homomorphisms in C^*-algebras, Lie C^*-algebras and JC^*-algebras, and derivations on C^*-algebras, Lie C^*-algebras and JC^*-algebras associated with the above additive ρ-functional inequalities.

II-9 (15:00 – 15:20)

Δ-Convergences of Projection Algorithms in $\mathrm{CAT}(\kappa)$ spaces

Byoung Jin Choi
Chungbuk National University

In this talk, we first introduce several projection algorithms in $\mathrm{CAT}(\kappa)$ spaces with $\kappa > 0$. Secondly, we will present the Δ-convergence of projection algorithms in $\mathrm{CAT}(\kappa)$ spaces.

III. Geometry and Tolopogy

(산학협력관 301호)

III-1 (09:30 – 09:50)

Shadowable points for finitely generated group actions

Sang Jin Kim

Chungnam National University

Recently Morales (2016) introduced the notion of shadowable point for a homeomorphism on a compact metric space. In this talk, introduce a concept of shadowable point for finitely generated group action T on a compact metric space and show that shadowable points for show that every distal action does not have shadowable points on a compact connected metric space.

III-2 (09:50 – 10:10)

On supports of strongly expansive measure

Woochul Jung

Chungnam National University

We prove that a homeomorphism of a compact metric space has an expansive measure, and study homeomorphisms for which the expansive measures are dense in the space of Borel probability measures. In this talk we introduce the concept of strongly expansive measure and prove that these measures exhibit a dense set of Borel probability measures with supports.

III-3 (10:10 – 10:30)

Density of expansive measures

Bomi Shin

Chungnam National University

In this talk, we study expansive measures of homeomorphisms f on a compact metric space, and find some necessary conditions so that the set of all expansive measures of f is dense in the set of all Borel probability measures.

III-4 (13:00 – 13:20)

Various expansive measures for flows

Nguyen Ngoc-Thach
Chungnam National University

"In this talk, we introduce a concept of weak expansive measure for flows which is really weaker than that of expansive measure, and show that there is a weak measure-expansive flow on a closed surface. Moreover we prove that if any nonempty open subset of X intersect with uncountably many orbits of a flow ϕ, then the set of ϕ-orbit-vanishing measures is dense in the set of all Borel probability measures on X with weak*-topology. The result is applied to characterize the set of weak measure-expansive flows using the notion of countably expansive flows. Finally we show that the integrated flow of a C^1 vector field on a compact smooth manifold is C^1 stably expansive if and only if it is C^1 stably weak measure-expansive. *This is a joint work with K. Lee.*"

III-5 (13:20 – 13:40)

Various topological dimensions on Cantor sets.

Suji Yun
Chungnam National University

In this talk we briefly recall the Cantor set with positive Lebesgue measure and the topological properties of the Cantor sets. Then we discuss basic properties about the Hausdorff dimensions and fractal dimension of topological spaces and give example related dimensions of the Cantor sets. Furthermore, we apply dimension's results to global attractors.

III-6 (13:40 – 14:00)

Rectifying space-like submanifolds in Pseudo-Euclidean spaces

Yun Myung Oh
Andrews University

Bang-Yen Chen
Michigan State University

Rectifying subspace and rectifying submanifold were defined by Bang-Yen Chen in 2016 [Int. Electron. J. Geom. 9] and he obtained several fundamental properties of rectifying submanifold in Euclidean space. In this talk, further results will be discussed for the rectifying space-like submanifolds in Pseudo-Euclidean spaces with codimension greater

one.

III-7 (14:20 – 14:40)

Diffeomorphisms with the strong average shadowing property on closed manifolds

Bowon Kang
Chungnam National University

Namjip Koo
Chungnam National University

Manseob Lee
Mokwon University

K. Sakai studied the dynamics of diffeomorphisms with the average-shadowing property on two-dimensional closed manifolds. In this talk we will introduce the notion of strong average shadowing property for diffeomorphisms on closed manifolds. Using this property we will improve Sakai's previous results.

III-8 (14:40 – 15:00)

Some characterizations of real hypersurfaces in complex Grassmannians with rank two

Hyunjin Lee
Kyungpook National University

Young Jin Suh
Kyungpook National University

A main objective in submanifold geometry is the classification of homogeneous hypersurfaces arise as principal orbits of cohmogeneity one actions, and so their classification is equivalent to the classification of cohomogeneity one actions up to orbit equivalence. Actually, the classifications of cohomogeneity one actions in irreducible simply connected Riemannian symmetric spaces of rank 2 of (non)compact type was obtained by J. Berndt and Y.J. Suh for complex two-plane Grassmannians $SU_{2+m}/S(U_2U_m)$ and complex hyperbolic two-plane Grassmannians $SU_{2,m}/S(U_2U_m)$. From these classifications, in (Suh, Adv. Appl. Math. 50, 645-659, 2013) Suh classified real hypersurfaces with isometric Reeb flow in $SU_{2,m}/S(U_2U_m)$, $m \geq 3$. Each one can be described as a tube over a totally geodesic $SU_{2,m-1}/S(U_2U_{m-1})$ in $SU_{2,m}/S(U_2U_m)$ or a horosphere whose center at infinity is singular. By using this result, we want to give another characterization for these model spaces with respect to the derivatives of (1,1) type tensor on real hypersurfaces in complex Grassmannians with rank two.

III-9 (15:00 – 15:20)

Vanishing theorems of the basic harmonic forms on a complete foliated manifold

Seoung Dal Jung
Jeju National University

On a compact foliated Riemannian manifold, it is well known that there are no non-trivial basic harmonic forms by M. Min-Oo et al. In this talk, we extend this results to a complete foliated Riemannian manifold. That is, on a foliated manifold whose all leaves are compact and the mean curvature is bounded, if the curvature endomorphism is positive-definite, then any basic harmonic forms with a finite global norm are trivial.

IV. Applied Mathematics
(산학협력관 302호)

IV-2 (09:50 – 10:10)

On the existence problem of a square matrix U such that $UU^T = -I$ over $\mathbb{Z}_{p^m}$

Sunghyu Han
Korea University of Technology and Education

There are many construction method for self-dual codes. One of them is the building-up construction. Recently a new building-up construction method published [S. Han, A method for constructing self-dual codes over $\mathbb{Z}_{2^m}$, Des. Codes Cryptogr. 75, 253–262 (2015)]. In the new method, the existence of a square matrix U such that $UU^T = -I$ is very important. In this paper, we completely solve the existence problem of the matrix U over $\mathbb{Z}_{p^m}$, where p is an arbitrary prime number.

IV-3 (10:10 – 10:30)

Steady state positive solution to population model with competition

Joon Hyuk Kang
Andrews University

We investigate mathematical conditions to guarantee the existence and uniqueness of positive solutions to a general elliptic mathematical model.This result generalizes the existence and uniqueness of positive steady state solutions to a Lotka-Volterra competition model with homogeneous boundary conditions for two species of animals competing in the same environment. Under what conditions do they coexist peacefully? It is natural to say that they can coexist peacefully if their reproduction rates and self-limitation rates are relatively larger than those of competition rates. In other words, they can survive if they interacts strongly among themselves and weakly with others.

IV-4 (13:00 – 13:20)

Option without Expiration date Underlying Stochastic Volatility model

Min-Ku Lee
Kunsan National University

Jeong-Hoon Kim
Yonsei University

In this research, we find the analytic pricing formula for the options without expiration date. Under the assumption that the underlying asset of the options follows a stochastic volatility model, we investigate the features of the options in comparison with the Black-Scholes price.

IV-5 (13:20 – 13:40)

A finite element dual singular function method to solve the Stokes equations including corner singularities

Jae-Hong Pyo
Kangwon National University

The finite element dual singular function method [FE-DSFM] has been constructed and analyzed accuracy by Z. Cai and S. Kim to solve the Laplace equation on a polygonal domain with one reentrant corner. In this paper, we impose FE-DSFM to solve the Stokes equations via the mixed finite element method. To do this, we compute the singular and the dual singular functions analytically at a non-convex corner. We prove well-posedness by using the contraction mapping theorem and then estimate errors of the algorithm. We obtain optimal accuracy $O(h)$ for velocity in $\mathbf{H}^1(\Omega)$ and pressure in $L^2(\Omega)$, but we are able to prove only $O(h^{1+\lambda})$ error bounds for velocity in $L^2(\Omega)$ and stress intensity factor, where λ is the eigenvalue. However, we get optimal accuracy results in numerical experiments.

IV-6 (13:40 – 14:00)

On developing a family of higher order multiple-root finders and illustrating their dynamics

Young Hee Geum
Dankook University

We develop a family of optimal fourth-order multiple-root finders and illustrate their basins of attraction. Möbius conjugacy maps and extraneous fixed points applied to a prototype quadratic polynomial raised to the power of the known integer multiplicity m are investigated. The illustrative basins of attractions applied to several test polynomials and the corresponding statistical result for convergence are shown to confirm the theoretical convergence.

IV-7 (14:20 – 14:40)

Superconvergence of finite element methods and its application

Kwang-Yeon Kim

Kangwon National University

In this talk we discuss some superconvergence results for the continuous finite element approximation u_h of second order elliptic equations on uniform and mildly structured meshes. Based on the superconvergence analysis of Bank and Xu in 2003, we first present some key identities for the standard nodal interpolant u_I of the exact solution u. Then, by combining these identities with the properties of uniform and mildly structured meshes, we establish the super-closeness between u_h and u_I with respect to the H^1 norm. As an application of this super-closeness, we show that a simple averaging of the discrete gradient ∇u_h can give a superconvergent approximation to ∇u and prove the asymptotic exactness of some a posteriori error estimators based on this gradient recovery.

IV-8 (14:40 – 15:00)

Numerical methods under the regime-switching jump-diffusion model with nonconstant variables

Younhee Lee
Chungnam National University

Sunju Lee
Chungnam National University

In this talk, we evaluate the values of European and American options under regime-switching jump-diffusion models which lead to partial integro-differential equations (PIDEs) and linear complementarity problems (LCPs) with variable coefficients respectively. We introduce three numerical methods, called IM, CN, and BDF2 methods, to solve the PIDEs approximately. It can be shown that these methods have the second-order convergence rate in the time and spatial variables. A variety of numerical experiments are carried out to demonstrate the convergence behaviors of the European and American option prices

IV-9 (15:00 – 15:20)

Numerical Analysis of the Helmholtz Equation on an Annular Domain

June Gi Kim
Kangwon National University

We construct generalized usual basis functions for numerical approximation of the Helmholtz equations on an annular domain. The basis functions constructed in the way catch the symmetries of the domain and the fundamental solutions of the Helmholtz equation and give effective approach in calculating complex eigenvalues of the equation.

V. Mathematical Education and Analysis II

(산학협력관 304호)

V-2 (09:50 – 10:10)

A Case Study of College Math Courses with Self-Directed Team Learning

Sook Min

Yonsei University at Wonju

This study aims to find the pedagogical utility and educational impact of self-directed learning method in the context of basic undergraduate calculus courses. A total of 133 engineering and science majoring students participated in the 16-week long class study administered in self-directed learning teaching styles in Spring 2015. Three major forms of self-directed teaching format were utilized: (1) a self-chosen syllabus, (2) self-engaged group problem solving, and (3) self-directed team projects. The qualitative analysis of students' final reports demonstrated that students experienced a high level of successful mastery experience in math, an ample opportunities of interactive vicarious learning, and a good amount of positive social influence from their classmates. Implications and future directions for the practice of self-directed learning on math education are discussed.

V-3 (10:10 – 10:30)

A study on application of GeoGebra in high school mathematics course

Seon Min Baek

Kyung Hee University

Kyungsoo Kim

Kyung Hee University

Recently, it is recommended to use engineering tools in mathematics education in order to enhance student understanding by visualizing fundamental concepts and corresponding figures. In this study, the GeoGebra was utilized to develop a teaching-learning guidance for high school mathematics course. A class worksheet for definite integral with the GeoGebra was designed as a case study.

V-4 (13:00 – 13:20)

Bishop-Phelps-Bollobas property

Sun Kwang Kim
Kyonggi University

Han Ju Lee
Dongguk University

Miguel Martin
University of Granaday

In 1963, Lindenstrauss studied extensions of the Bishop-Phelps theorem to the vector-valued case which is the starting point of norm attaining operators theory. In 2008, Acosta, Aron, García and Maestre started the study of vector-valued versions of the Bishop-Phelps-Bollobás theorem. This is called now a days Bishop-Phelps-Bollobás property. In this talk, we introduce some results on this topic and possible extension to other mappings.

V-5 (13:20 – 13:40)

Weighted $L_{p,q}$-estimates for higher order parabolic systems

Jongkeun Choi
Korea University

Doyoon Kim
Korea University

We prove weighted $L_{p,q}$-estimates for divergence type higher order elliptic and parabolic systems with irregular coefficients on Reifenberg flat domains. In particular, in the parabolic case the coefficients do not have any regularity assumptions in the time variable. As functions of the spatial variables, the leading coefficients are permitted to have small mean oscillations. The weights are in the class of Muckenhoupt weights A_p.

V-6 (13:40 – 14:00)

Multiscale Stochastic Volatility Effects on Gaussian Copula

Yong-Ki Ma
Kongju National University

Donghyun Cho
Kyonggi University

Gaussian copula is one of representative copulas used in the financial industry. The main assumption of the Gaussian copula is to consider that the random variables are normally distributed and their joint distribution is multivariate normal. However, it has a major drawback: it does not exhibit tail dependence. To overcome this problem, we suggest a multiscale stochastic volatility model. More precisely, we consider volatility processes which are driven by two diffusions; one fluctuating on a fast time scale and the other fluctuating on a slowly varying diffusion process. Based on this model, an approximate formula is obtained for the joint transition density and then it is applied to the Gaussian copula.

V-7 (14:20 – 14:40)

A measurable function over continuous paths similar to the Paley-Wiener-Zygmund integral

Donghyun Cho
Kyonggi University

Yong-Ki Ma
Kongju National University

Let $C[0,T]$ denote the space of continuous real-valued functions on the interval $[0,T]$. On the space $C[0,T]$ we introduce a finite measure $w_{\alpha,\beta;\varphi}$ and investigate its properties, where φ is arbitrary finite initial measure on $(\mathbb{R},\mathcal{B}(\mathbb{R}))$. Using this finite measure $w_{\alpha,\beta;\varphi}$ we also introduce a measurable function on $C[0,T]$ which is similar to the Paley-Wiener-Zygmund integral on the generalized analogue of Wiener space. As applications we introduce a Banach algebra which corresponds the Cameron-Storvick's Banach algebra $\mathcal{S}$ on the classical Wiener space. We note that if $\varphi(\mathbb{R}) = 1$, then $w_{\alpha,\beta;\varphi}$ is a probability measure with the mean function α and the variance function β, and that the measurable function is the Paley-Wiener-Zygmund integral on the analogue of Wiener space $C[0,T]$.

V-8 (14:40 – 15:00)

Numerical simulation of a shear-flow instability with surface tension

Suyeon Shin
Korea University

Sung-Ik Sohn
Gangneung-Wonju National University

Woonjae Hwang
Korea University

One of the most well known instabilities in fluid mechanics is the instability at the interface between parallel shear flow of different velocities, which is called Kelvin-Helmholtz instability. When surface tension is present on the interface, numerical computation is not an easy talk, due to the aliasing instability. We develop a stable numerical method by using the vortex sheet model and present long-time evolutions of the Kelvin-Helmholtz instability with surface tension and density jump. A variety of interesting behaviors by the interaction of singularity and surface tension will be demonstrated.

VI. Rising Mathematicians
(산학협력관 305호)

VI-2 (09:50 – 10:10)

A note on the space of isometry classes of compact metric spaces

Hyun Hee Lee
Chungnam National University

Namjip Koo
Chungnam National University

Gromov introduced a classic notion of convergence for maps defined on metric spaces with distinguished points. In this talk we briefly recall the notion of the Gromov-Hausdorff distance between metric spaces that is derived from the classic notion. Then we discuss some basic topological properties on the metric space of isometry classes of compact metric spaces suggested by C. A. Morales.

VI-3 (10:10 – 10:30)

Lie-Trotter means of positive definite matrices

Jinmi Hwang
Chungbuk National University

Sejong Kim
Chungbuk National University

"As extension of the Lie-Trotter product formula, we define the two-variable and multivariable Lie-Trotter means with several examples including the Sagae-Tanabe and Hansen inductive means. We show that the weighted means satisfying the arithmetic-geometric-harmonic mean inequalities are the multivariable Lie-Trotter means. We finally give a few interesting versions of the extended Lie-Trotter formula derived from multivariable Lie-Trotter means."

VI-4 (13:00 – 13:20)

The weak* topology on measure spaces

Meihua Dong
Chungnam National University

In this talk, we will discuss fundamental properties of the weak * topology on measure

spaces which will be useful for the study of measurable dynamic on group actions.

VI-5 (13:20 – 13:40)

The mass formula of self-orthogonal codes over GF(q)

Kwang Ho Kim
Kangwon National University

There exists already mass formula which is the number of self orthogonal codes in $GF(q)^n$, but not proof of it. We describe some theories about finite geometry and by using them proved the mass formula when $q = p^m$, p is odd prime.

VI-6 (13:40 – 14:00)

Riemann problem for 2×2 hyperbolic system

Jin Ah Hwang
Korea University

Woonjae Hwang
Korea University

We construct the solution of two-dimensional Riemann problem for hyperbolic system with anisotropic flux functions. We consider two constant Riemann data separated by x-positive and y-positive axes and the cases of one wave or two waves at each initial discontinuity. We also demonstrate the numerical solution.

VI-7 (14:20 – 14:40)

Analytic real algebras

Young Joo Seo
Hanyang University

Hee Sik kim
Hanyang University

In this paper we construct some real algebras by using elementary functions, and discuss some relations between several axioms and its related conditions for such functions. We obtain some conditions for real-valued functions to be a (edge) d-algebra.

VI-8 (14:40 – 15:00)

Cauchy-Jensen ρ-functional inequalities

Eun Hwa Shim
Hanyang University

Choonkil Park
Hanyang University

In this talk, we solve the additive ρ-functional inequalities

$$\|f(x+y)-f(x)-f(y)\| \leq \left\|\rho\left(2f\left(\frac{x+y}{2}\right)-f(x)-f(y)\right)\right\|$$

where ρ is a fixed complex number with $|\rho|<1$, and

$$\left\|2f\left(\frac{x+y}{2}\right)-f(x)-f(y)\right\| \leq \|\rho\left(f(x+y)-f(x)-f(y)\right)\|,$$

where ρ is a fixed complex number with $|\rho|<1$. Furthermore, we prove the Hyers-Ulam stability of the above additive ρ-functional inequalities in complex Banach spaces.

VI-9 (15:00 – 15:20)

Application of principal component analysis and support vector machine to data sets with weak correlation

Yunkyung Park
Kyung Hee University

Kyungsoo Kim
Kyung Hee University

The principal component analysis (PCA) and the support vector machine (SVM) are widely used data analysis tools. In this study, these data analysis tools were applied to investigate the relationship between two data sets that have weak or no correlation. The data sets were the grade point averages and academic satisfaction scores of 222 university students in six groups.