International Workshop on Applied Analysis and Optimization

2015 應用分析與最佳化國際研討會

6JUNE/26-28

Research Center for Interneural Computing,
China Medical University,
Taichung, Taiwan

Keynote Speakers

Kenro Furutani (Tokyo University of Sciences, Japan),

Mau-Hsiang Shih (China Medical University, Taiwan),

Wataru Takahashi (Kaohsiung Medical University, Taiwan)

China Medical University
China Medical University Hospital
Kaohsiung Medical University
Ministry of Science and Technology
National Sun Yat-sen University

Local Contact:

Jen-Chih Yao, Tel (886)-7-5252000 ext.3816, Email: yaojc@math.nsysu.edu.tw

Mr. Zong-Kai Hsu, Tel (886)-4-22053366 ext.8504, Email: cmuh27878@gmail.com

Program schedule of IWAAO2015

Friday, June 26, 2015

(Venue:203 classroom, 2F in Lifu Hall)

13:00~13:20 Registration (報到)	
13:20~13:30 Opening ceremony (開幕式) **Opening speech: Jen-Chih Yao**	
Chair:	Mau-Hsiang Shih
13:30~14:20	Keynote Speech: Wataru Takahashi Iterative Methods for Split Common Null Point Problems in Banach Spaces
14:20~14:50 Break	
14:50~17:00	**Section 1** **Chair: Der-Chen Chang**
14:50~15:30	Wolfgang Schulze Ellipticity of APS-Type on Manifolds with Edge
15:30~16:20	Shigeo Akashi Set-valued theoretic classification of reproducing kernel Hilbert spaces included by L^2 [0,1]
16:20~17:00	Wolfram Bauer Regularized determinant for elliptic and sub-elliptic operators
17:30~19:30 Reception (Venue: The atrium of Xueshi gate, 2F in Lifu Hall)	

Saturday, June 27, 2015

(Venue:203 classroom, 2F in Lifu Hall)

8:30~9:30 Registration (報到)
Chair: Hong-Kun Xu
9:30~10:20 Keynote Speech: Mau-Hsiang Shih The Tendency toward a Moving Equilibrium
10:20~10:40 Break
10:40~12:00 Section 2 Chair: Yutain Li
10:30~11:20 D. R. Sahu Acceleration and perturbation of iterative techniques with applications
11:20~12:00 Weiping Shen Newton-Type Methods for Inverse Singular Value Problems with Multiple Singular Values
12:00~13:30 Lunch
13:30~15:30 Section 3 Chair: Chisato Iwasaki
13:30~14:10 Jishan Hu Painlevé Analysis for Hamiltonian Systems
14:10~14:50 Sy-Ming Guu On sensitivity analysis of inverse singular value problems
14:50~15:30 Ngai-Ching Wong Preconditioning Random Toeplitz Systems
15:30~16:00 Break
16:00~17:20 Session 4 Chair: Sy-Ming Guu
16:00~16:40 Ya-Shu Wang Orthogonally additive holomorphic maps between fourier algebras
16:40~17:20 Chisato Iwasaki Construction of a fundamental solution for parameter family of operators of Grushin type
17:30~19:30 Banquet (Venue: Gourmet brasserie in The Splendor Hotel)

Sunday, June 28, 2015

(Venue:203 classroom, 2F in Lifu Hall)

8:30~9:30 Registration (報到)	
Chair:	Wolfgang Schulze
9:30~10:20	Keynote Speech: Kenro Furutani Grushin type operators and their bicharacteristic flow
10:20~10:40 Break	
10:40~12:00	**Section 5 Chair: Jishan Hu**
10:40~ 11:20	Jian-Wen Peng Levitin-Polyak well-posedness of a system of generalized vector variational inequality problems
11:20~12:00	Yutain Li Diffusion Processes and Degenerated Parabolic PDEs for Option Pricing Problems
12:00~13:30 Lunch	
13:30~15:20	**Section 6 Chair: Ngai-Ching Wong**
13:30-14:10	Xiaojing Lyu Compositions of Operators in the Edge Calculus
14:10-14:50	Hong-Kun Xu Optimization Algorithms for Compressed Sensing
14:50-15:20	Yen-Cherng Lin Minimax Problems with Multilayer Structures
15:20-16:00 Break and closed session	

International Workshop on Applied Analysis and Optimization

2015 應用分析與最佳化國際研討會

Day 1

Keynote Speech:

Prof. Wataru Takahashi

Iterative Methods for Split Common Null Point Problems in Banach Spaces

Wataru Takahashi

Center for Fundamental Science, Kaohsiung Medical University,
Kaohsiung 80702, Taiwan
and Department of Mathematical and Computing Sciences, Tokyo Institute of Technology, Ookayama, Meguro-ku, Tokyo 152-8552, Japan

Let H_1 and H_2 be two real Hilbert spaces. Let D and Q be nonempty, closed and convex subsets of H_1 and H_2, respectively. Let $A : H_1 \to H_2$ be a bounded linear operator. Then the *split feasibility problem* is to find $z \in H_1$ such that $z \in D \cap A^{-1}Q$. Recently, Byrne, Censor, Gibali and Reich also considered the following problem: Given set-valued mappings $A_i : H_1 \to 2^{H_1},\ 1 \le i \le m$, and $B_j : H_2 \to 2^{H_2},\ 1 \le j \le n$, respectively, and bounded linear operators $T_j : H_1 \to H_2,\ 1 \le j \le n$, the *split common null point problem* is to find a point $z \in H_1$ such that

$$z \in \left(\bigcap_{i=1}^{m} A_i^{-1}0\right) \cap \left(\bigcap_{j=1}^{n} T_j^{-1}(B_j^{-1}0)\right),$$

where $A_i^{-1}0$ and $B_j^{-1}0$ are null point sets of A_i and B_j, respectively. Defining $U = A^*(I - P_Q)A$ in the split feasibility problem, we have that $U : H_1 \to H_1$ is an inverse strongly monotone operator, where A^* is the adjoint operator of A and P_Q is the metric projection of H_2 onto Q. Furthermore, if $D \cap A^{-1}Q$ is nonempty, then $z \in D \cap A^{-1}Q$ is equivalent to

$$z = P_D(I - \lambda A^*(I - P_Q)A)z, \tag{1}$$

where $\lambda > 0$ and P_D is the metric projection of H_1 onto D. Using such results regarding nonlinear operators and fixed points, many authors have studied the split feasibility problem and the split common null point problem in Hilbert spaces.

In this talk, motivated by iterative methods for split feasibility problems and split common null point problems in Hilbert spaces, we consider such problems in Banach spaces. Then, using geometry of Banach spaces, we establish weak and strong convergence theorems for split feasibility problems and split common null point problems in Banach spaces. It seems that such theorems are first in Banach spaces.

Keywords and phrases: Maximal monotone operator, fixed point, split feasibility problem, split common null point problem, iteration procedure, duality mapping.

E-mail address: wataru@is.titech.ac.jp; wataru@a00.itscom.net

Ellipticity of APS-Type on Manifolds with Edge

B.-W. Schulze
Institute of Mathematics
University of Potsdam, Am Neuen Palais 10
D-14469 Potsdam, Germany
Email: schulze@math.uni-potsdam.de

Abstract. Ellipticity and index of differential operators on manifolds with boundary have been studied by Atiyah, Patodi and Singer [1]. Since then many other authors contributed more results and new insight. Large schools in geometric analysis live from the original ideas, often characterized as boundary value problems (BVPs) with APS-conditions. In contrast to the index theory in Boutet de Monvel's work [3] for the case of BVPs with the transmission property and Shapiro-Lopatinskij (SL) ellipticity of boundary conditions the subsequent development essentially concentrated on first order elliptic differential equations with vanishing right hand sides and L^2 realizations of operators with a dense domain. On the other hand, looking at the original structure of the Atiyah-Singer index theorem and the achievements of the pseudo-differential analysis in this period, it remained a natural question on how to solve BVPs also for non-homogeneous equations of arbitrary order. There is a long list of authors with results in this direction, e.g., by Grubb and Seeley and by Nazaikinskij, Shatalov, and Sternin in joint works with the speaker. The problem of constructing parametrices of elliptic BVPs for differential operators with analogues of APS-conditions, called global projection conditions, within an algebra of Toeplitz type operators [**?**] has been solved in [**?**], and it has been shown that every elliptic pseudo-differential operator with the transmission property admits either elliptic APS or SL conditions which imply Fredholmness in higher analogues of Hardy spaces on the boundary or standard Sobolev spaces. The SL-elliptic case is a special case of APS. The difference between both is characterized by vanishing or non-vanishing of a topological obstruction, first observed by Atiyah and Bott in [1] for elliptic differential operators. Since manifolds with boundary are a special case of manifolds with edge, similar questions and answers makes sense in the edge case. Edge problems with elliptic global projection as well as analogues of SL conditions have been treated in joint papers with Seiler [9],[8]. The present talk is based on new achievements on the edge calculus, originally established in [7], moreover, on results in different joint works with Lyu [6] and Chang [4] which can be applied to global projection conditions on manifolds with edge in terms of a new transparent construction of parametrices within the global projection conditions edge algebra, as is done in joint work with Liu [5].

References

[1] M.F. Atiyah, and R. Bott, *The index problem for manifolds with boundary*, Coll. Differential Analysis, Tata Institute Bombay, Oxford University Press, Oxford 1964, pp. 175-186.

[2] M.F. Atiyah, V. Patodi, and I.M. Singer, *Spectral asymmetry and Riemannian geometry I, II, III* Math. Proc. Cambridge Philos. Soc., **77,78,79** (1975, 1976, 1976), 43-69, 405-432, 315-330.

[3] L. Boutet de Monvel, *Boundary problems for pseudo-differential operators*, Acta Math. **126** (1971), 11-51.

[4] D.-C. Chang, X. Lyu, and B.-W. Schulze, *Corner Mellin operators with holomorphic symbols*, (in progress).

[5] X. Liu and B.-W. Schulze, *Boundary value problems with global projection conditions*, (in preparation; state April 2015).

[6] X. Lyu and B.-W. Schulze, *Mellin operators in the edge calculus*, (to be submitted)

[7] B.-W. Schulze, *Pseudo-differential operators on manifolds with edges*, Teubner-Texte zur Mathematik **112**, Symp. "Partial Differential Equations, Holzhau 1988", BSB Teubner, Leipzig, 1989, pp. 259-287.

[8] B.-W. Schulze and J. Seiler, *Pseudodifferential boundary value problems with global projection conditions*, J. Funct. Anal. **206**, 2 (2004), 449-498.

[9] B.-W. Schulze and J. Seiler, *Edge operators with conditions of Toeplitz type*, J. of the Inst. Math. Jussieu, **5**, 1 (2006), 101-123.

Set-valued theoretic classification of reproducing kernel Hilbert spaces included by $L^2[0,1]$

Shigeo Akashi and Satoshi Kodama

Department of Information Sciences, Faculty of Science and Technology,
Tokyo University of Science, Japan

Abstract: In this talk, set-valued theortic methods are applied to geometric characterization of the images of the closed unit ball under the compact positive operators defined on $L^2[0,1]$. Exactly speaking, the classification problem of subspaces with norms characterized by the images of the closed unit ball under the compact positive operators are discussed. These results are applied to classifying reproducing kernel Hilbert spaces whose kernels are jointly continuous on $[0,1]^2$.

Regularized determinant for elliptic and sub-elliptic operators

Wolfram Bauer

Leibniz University Hannover,
GERMANY
email: bauer@math.uni-hannover.de

The analysis of the spectral zeta function for elliptic operators has a long tradition and leads to interesting spectral invariants. In some cases it allows to define the so-called zeta-regularized determinant of operators with discrete spectrum consisting of eigenvalues with finite multiplicities. In this talk we explain a method of how to calculate these determinants for the Laplace-Beltrami operator acting on functions over manifolds with constant curvature one (spherical space forms). It turns out that in some cases the spectral zeta function of the sub-Laplace operator can be defined in an analogous way and it defines a holomorphic function in a zero-neighborhood of the complex plane. In the second part of the talk we discuss specific cases and we provide explicit formulas for the sub-Laplacian on the 3-sphere, Heisenberg manifolds or product spaces. This is joint work with K. Furutani (Tokyo).

Talk at "2015 International Workshop on Applied Analysis and Optimization", June 26th Taichung.

International Workshop on Applied Analysis and Optimization

2015 應用分析與最佳化國際研討會

Day 2

Keynote Speech:

Prof. Mau-Hsiang Shih

The Tendency toward a Moving Equilibrium

Mau-Hsiang Shih

Research Center for Interneural Computing
China Medical University
Taichung 40402, Taiwan
E-mail: mhshih@mail.cmu.edu.tw

Abstract. The chasing problem of how the actual values chase a moving equilibrium was raised explicitly in 1965 by John Hicks. To address the issue, we formalize a framework of discrete nonautonomous dynamical systems associated with a moving equilibrium, and develop analytical methods for analyzing the tendency toward the moving equilibrium. We seek to embody Marshall's economic tendency principle applied to the tendency toward a moving equilibrium in mathematical form. It establishes the equivalence that a nonautonomous flow chases a moving equilibrium if and only if the tendency is produced in a bounded sequence of periods. The equivalence assertion is key to resolving the chasing problem of economic significance. As a result, we construct a model of an evolving competitive economy underlying price adjustments to describe the supply, demand and prices starting in the vicinity of a moving equilibrium remaining close to it.

*This is a joint work with Sheng-Yi Hsu.

ACCELERATION AND PERTURBATION OF ITERATIVE TECHNIQUES WITH APPLICATIONS

D. R. SAHU

Abstract. During the last two decades, different modifications of fixed point and proximal point iterative techniques were introduced for solving various nonlinear problems in Hilbert and Banach spaces. We combine these modifications and accelerate to get some new accelerated perturbed iterative techniques. These techniques are applied to solve fixed point problems inclusion problems, and some other problems.

Department of Mathematics, Banaras Hindu University, Varanasi-221005, India
E-mail address: drsahudr@gmail.com

Key words and phrases. Accretive operator, Mann iteration, maximal monotone operator, metric projection mapping, Picard iteration, proximal point algorithm, regularization method, S-iteration.
2000 Mathematics Subject Classification: 47J20, 49J40, 65J15 .

Newton-Type Methods for Inverse Singular Value Problems with Multiple Singular Values

Wei-Ping Shen

Department of Mathematics
Zhejiang Normal University
Jinhua 321004, China
Email: shenweiping@zjnu.cn

Abstract. We consider the convergence problem of Newton-type methods for solving the inverse singular value problem with multiple singular values. Under the nonsingularity assumption of the (relative) generalized Jacobian matrices at the solution c^*, a convergence analysis covering both the distinct and multiple singular values cases is provided and the superlinear or quadratical convergence properties are proved. Moreover, numerical experiments are given in the last section and comparisons are made.

Painlevé Analysis for Hamiltonian Systems

Jishan Hu

Department of Mathematics
HKUST

Abstract. In this talk, we first introduce the Cauchy-Kowalevski Theorem and the Painlevé test. Then we show that if a regular Hamiltonian system of ordinary differential equations passes the Painlevé test, then there is a canonical triangular change of variable, such that the system is converted to another regular Hamiltonian system, and the Laurent series solutions are converted to power series solutions. Moreover, if the system is autonomous, then the new Hamiltonian function is obtained by substituting the new variables. If the system is not autonomous, then the new Hamiltonian function is obtained by substituting the new variables and then dropping the singular terms.

*This is a joint work with Min Yan.

On sensitivity analysis of inverse singular value problems

Wei-ping Shen* Sy-Ming Guu† Chong Li‡

Abstract. Inverse singular value problems arise in various applications such as the optimal sequence designed for direct-spread code division multiple access, the passivity enforcement in nonlinear circuit simulation, the constructions of Toeplitz-related matrices from prescribed singular values, the inverse problem in some quadratic group, and the construction of nonnegative, positive and anti-bisymmetric matrices with prescribed singular values. In this talk, we review some source problems and consider the sensitivity of the inverse singular value problems. Under the assumptions that the given singular values are distinct and the Jacobian matrix at the solution are nonsingular, we establish a perturbation theorem where the existence of solutions to the perturbed problem is proved and the estimation is presented. Moreover, numerical experiments are given to illustrate our theoretical result.

Key words. Inverse problem, singular value, Newton's method

AMS subject classification. *15A29, 15A18, 65F15*

*Corresponding author. Department of Mathematics, Zhejiang Normal University, Jinhua 321004, P. R. China (shenweiping@zjnu.cn). This author was supported in part by the National Natural Science Foundation of China (grant 11101379).

†Graduate Institute of Business and Management, College of Management, Chang Gung University and Medical Research Division, Chang Gung Memorial Hospital, Taiwan, R.O.C (iesmguu@gmail.com). Research was partially supported by NSC 102-2221-E-182-040-MY3 and BMRPD17.

‡Department of Mathematics, Zhejiang University, Hangzhou 310027, P. R. China (cli@zju.edu.cn). This author was supported in part by the National Natural Science Foundation of China (grants 11171300, 11371325).

Preconditioning Random Toeplitz Systems

Ngai-Ching Wong

National Sun Yat-Sen University
E-mail: wong@math.nsysu.edu.tw

Abstract. In this talk, we establish the algebraic properties of random Toeplitz operators following Brown and Halmos, and the Fourier theory of Toeplitz forms following Szego. We study the distribution of the eigenvalue functions of a random Toeplitz matrix and the preconditioning of a random Toeplitz operator by the Strang circulants following Raymond Chan. This is to be applied in solving random Toeplitz systems $Tx = b$ by the preconditioned conjugate gradient method. Numerical examples are given.

ORTHOGONALLY ADDITIVE HOLOMORPHIC MAPS BETWEEN FOURIER ALGEBRAS

YA-SHU WANG

ABSTRACT. Let G_1, G_2 be locally compact amenable groups, and let $B_{A(G_1)}(0,r)$ be the open ball in the Fourier algebra $A(G_1)$ centered at 0 of radius $r > 0$. Suppose that $H : B_{A(G_1)}(0,r) \to A(G_2)$ is a completely bounded, orthogonally additive and multiplicative, and conformal holomorphic map. We show that there exist a piecewise affine homeomorphism $\sigma : G_2 \to G_1$ and a sequence $\{\omega_n\}$ in the Fourier-Stieltjes algebra $B(G_2)$ such that

$$H(f)(y) = \sum_{n\geq 1} \omega_n(y) f(\sigma(y))^n, \quad \forall f \in B_{A(G_1)}(0;r).$$

Construction of a fundamental solution for parameter family of operators of Grushin type

Chisato Iwasaki
University of Osaka and University of Hyogo, Japan

Abstract. We will show a method of construction for a fundamental solution of the exact form for degenerate operators of Grushin type. This method can be applied to the Kohn-Laplacian with parameter. We will discuss the poles and its residues of the meromorphic extension of the fundamental solution. This is a joint work with W.Bauer and K.Furutani.

International Workshop on Applied Analysis and Optimization

2015 應用分析與最佳化國際研討會

Day 3

Keynote Speech:

Prof. Kenro Furutani

Grushin type operators and their bicharacteristic flow

Kenro Furutani
Tokyo University of Science

Abstract. In this talk after introducing some generalities on sub-Riemannian structure and a connection defined by it on a principal bundle, I will explain an application of a classical isoperimetric problem (F. Bernstein) on the standard 2-sphere to determine the singular geodesics on the Grushin sphere through the left and right Hopf fibration $S^3 \to S^2$.

Levitin-Polyak well-posedness of a system of generalized vector variational inequality problems

Jian-Wen Peng and Xin-Min Yang

School of Mathematics, Chongqing Normal University, Chongqing 400047, P. R. China

Abstract. In this paper, we introduce two types of the Levitin-Polyak well-posedness for a system of generalized vector variational inequality problems. By using the gap function of the system of generalized vector variational inequality problems, we establish the equivalent relationship between the two types of Levitin-Polyak well-posedness of the system of generalized vector variational inequality problems and the corresponding well-posednesses of the minimization problems. We also present some metric characterizations for the two types of the Levitin-Polyak well-posedness of the system of generalized vector variational inequality problems. The results in this paper generalize, extend and improve some known results in the literature.

Diffusion Processes and Degenerated Parabolic PDEs for Option Pricing Problems

Yutian LI
Department of Mathematics
Hong Kong Baptist Universi yutianli@hkbu.edu.hk

Abstract

Option is a kind of financial derivatives written on some other assets, such as stocks, foreign exchanges and bonds. The valuation of a given option is an important problem in finance, for which the mathematical framework is founded by Black-Scholes-Merton. The general idea of pricing an option is to model the dynamics of the underlying asset's price as a diffusion process, and by the Itô formula the option price follows a degenerated PDE of parabolic type. Black-Scholes-Merton model and its extensions, stochastic volatility models, are based on the Brownian motion. However, the recent empirical studies of the real market data suggests that the stock pricing follows a more general kind of diffusion processes, namely the Lévy process. In this talk, we shall review these models and their governing PDEs, and explain why the heat kernel plays an important role in the option pricing problem.

Compositions of Operators in the Edge Calculus

Xiaojing. Lyu
At Taichung

Abstract. The edge calculus, first established by B.-W. Schulze in [1], consists of edge-degenerate pseudo-differential operators in a suitable quantization in terms of holomorphic non-smoothing Mellin symbols, Mellin operators with smoothing meromorphic symbols, and Green operators. These operators form an algebra, i.e., it contains compositions and formal adjoint. In an article of J.Gil, B.-W. Schulze, and J.Seiler [2] there was found another independent proof, based on an analogue of Kumano-go's calculus for operator-valued Mellin symbols which also controls holomorphy in the complex Mellin covariable. A more detailed composition proof in "traditional" quantization has been delivered by B.-W. Schulze in [5]. The new results in the present talk concerns another more elementary proof of the composition theorem which refers to a pure Mellin quantization but on techniques that are devoted to generalizing the composition property of operators on manifolds with higher singularities. The approach is based on explicit evaluations of Mellin Leibnitz products , combined with commutation properties between weight factors and Mellin operators with holomorphic Mellin symbols, on the expense of admitted translations of symbols in the complex plane.

References

[1] B.-W. Schulze, *Pseudo-differential operators on manifolds with edges*, Teubner-Texte zur Mathematik **112**, Symp. "Partial Differential Equations, Holzhau 1988", BSB Teubner, Leipzig, 1989, pp. 259-287.

[2] J.B. Gil, B.-W. Schulze, and J. Seiler, *Cone pseudo-differential operators in the edge symbolic calculus*, Osaka J. Math. **37** (2000), 221-260.

[3] X. Lyu, *Asymptotics in weighted corner spaces*, Asian-European Journal of Mathematics. **7**, 3 (2014) 1450050 (36 pages).

[4] X. Lyu and B.-W. Schulze, *Mellin Operators in the edge calculus* (submitted)

[5] B.-W. Schulze, *Composition in the edge calculus*, Elliptic and Paabolic Equations, 2015.

2000 *Mathematics Subject Classification.* Primary 35S35; Secondary 35J70.

Optimization Algorithms for Compressed Sensing

Hong-Kun Xu
Department of Mathematics
Hangzhou Dianzi University
Hangzhou 310018, mainland China
E-mail: xuhk@hdu.edu.cn

Abstract

Compressed sensing (CS), essentially invented by Candes, Donoho, and Tao, aims to recover a sparse signal at a sampling rate that is significantly lower than the well established Nyquist rate. CS has been successfully applied to medical imaging, machine learning, and many other applied areas of science and engineering, and therefore been paid great attention recently. A key step of CS is to solve a certain kind of nonconvex/convex optimization problems, and the success of CS lies in the ℓ_1 magic which says that a nonconvex ℓ_0 minimization is reduced to a convex ℓ_1 minimization under certain assumptions on the sensing matrix (such as the restricted isometry property).

The purpose of this talk is to discuss some optimization algorithms that solve the optimization problems arising from CS, including the iterative hard/soft thresholding algorithms, and the proximal-projection algorithm.

Minimax Problems with Multilayer Structures

Yen-Cherng Lin
Department of Occupational Safety and Health,
College of Public Health,
China Medical University, Taichung 40402, Taiwan.
yclin@mail.cmu.edu.tw

Minimax problems are important in mathematical economics and game theory, in the meantime, it has been very useful in many applications in convex analysis and nonlinear analysis. One important extensional direction of minimax theorem is multilayer approach. We discuss the minimax problems for set-valued mappings with several layers structures, and scalar minimax theorems, minimax theorems, several layers minimax inequalities for set-valued mappings, and the existence of cone-saddle points.

Keywords:minimax theorems; minimax inequalities; cone-convexities; cone-saddle points

References

[1] Y.C. Lin, *The Hierarchical Minimax Theorems*, Taiwanese J. Math. **18**, (2014), 451–462.

[2] Y.C. Lin, C.-T. Pang, *The hierarchical minimax inequalities for set-valued mappings*, Abstr. Appl. Anal., **2014**, (2014) Article ID 190821, doi:10.1155/2014/190821.

[3] Y.C. Lin, Q.H. Ansari and H.C. Lai, *Minimax Theorems for Set-valued Mappings under Cone-convexities*, Abstr. Appl. Anal., **2012** (2012), doi:10.1155/2012/310818.

[4] S.J. Li, G.Y. Chen, K.L. Teo and X.Q. Yang, *Generalized Minimax Inequalities for Set-Valued Mappings*, J. Math. Anal. Appl., **281**, (2003), 707–723.

[5] C. Berge, *Topological spaces*, Macmillan, New York, 1963.

[6] J.P. Aubin, A. Cellina, *Differential Inclusions*, Springer-Verlag, Berlin-Heidelberg-New York-Tokyo, 1984.

[7] C. Gerth, P. Weidner, *Nonconvex separation theorems and some applications in vector optimization*, J. Optim. Theory Appl., **67**, (1990), 297–320.

[8] C.W. Ha, *A minimax theorem*, Acta Math.Hung. **101**, (2003), 149–154.

[9] Y.C. Lin, *Bilevel minimax theorems for non-continuous set-valued mappings*, J. Inequal. Appl. **2014**:182, (2014) doi:10.1186/1029-242X-2014-182.

[10] F. Ferro, *Optimization and stability results through cone lower semi-continuity*, Set-Valued Analysis, **5** (1997), 365–375.

International Workshop on Applied Analysis and Optimization

2015 應用分析與最佳化國際研討會

Appendix

IWAAO2015 Participants List			
No.	**Name**	**Institutions**	**Email**
1	Chisato Iwasaki	University of Hyogo, Japan	chisatoiwasaki@hotmail.com
2	Daya Ram Sahu	Banaras Hindu University, India	drsahudr@gmail.com
3	Der-Chen Chang	Georgetown University, USA	chang@georgetown.edu
4	Hong-Kun Xu	Hangzhou Dantz University, China	xuhk@math.nsysu.edu.tw
5	Jen-Chih Yao	China Medical University, Taiwan	yaojc@math.nsysu.edu.tw
6	Jian-wen Peng	Chongqing Normal University	jwpeng6@aliyun.com
7	Jishan Hu	Hong Kong University of Sciences and Technology, China	majhuhk@gmail.com
8	Jong-Shenq Guo	Tamkang University	jsguo@mail.tku.edu.tw
9	Kenro Furutani	Tokyo University of Sciences, Japan	furutani@ma.noda.sut.ac.jp
10	Mau-Hsiang Shih	China Medical University, Taiwan	mhshih@math.ntnu.edu.tw
11	Ngai-Ching Wong	National Sun Yat-sen University, Taiwan	wongngaiching@gmail.com
12	Shigeo Akashi	Tokyo University of Science Noda, Japan	akashi@is.noda.tus.ac.jp
13	Sy-Ming Guu	Chang Gung University, Taiwan	iesmguu@mail.cgu.edu.tw
14	Wataru Takahashi	Kaohsiung Medical University, Taiwan	wataru@a00.itscom.net
15	Wei-Ping Shen	Zhejiang Normal University	shenweiping@zjnu.cn
16	Wolfgang Schulze	University of Potsdam, Germany	schulze@math.uni-potsdam.de
17	Wolfram Bauer	Hannover University, Germany	bauer@math.uni-hannover.de
18	Xiaojing Lyu	Tianjin University of Technology and Education, China	lvxiaojing2006@126.com
19	Ya-Shu Wang	National Chung Hsing University, Taiwan	yashu@nchu.edu.tw
20	Yen-Cherng Lin	China Medical University, Taiwan	yclin@mail.cmu.edu.tw
21	Yutian Li	Hong Kong Baptist University	yutianli@hkbu.edu.hk

Maps and Transportations

China Medical University

Contact us

Phone: +886-4-2205-3366#8504

E-mail: cmuh27878@gmail.com Location: Taichung, Taiwan, R.O.C. China Medical University, Taiwan | No.91, Hsueh-Shih Road, Taichung, Taiwan 40402, R.O.C.

A. By Bus

From Taichung Train Station, take the local bus, Ren-You Bus No. 25 (which goes to the Overseas Chinese Institute of Technology). It takes about 20 minutes to get to Zhongshan Hall (CMU).

From Taichung Train Station, take the local bus, UBus No.61 (which goes to Taya). It takes about 20 minutes to get to Zhongshan Hall (CMU).

Take the local bus, Taichung Bus No. 1 or No. 131 (either of them passes by CMU).

B. By Car

1. Through National Freeway No.1
   (1) Northbound
   Drive along National Freeway No.1, take the exit at Taichung Interchange (178.6km) and follow the direction to Taichung. Drive along TaiJungGang Rd. Turn left in the Yingcai Rd. and go along till you meet Xueshi Rd. CMU is on the corner of Yingcai Rd and Xueshi Rd.

   (2) Southbound
   Drive along National Freeway No.1, take the exit at Daya Interchange (174.2km) and follow the direction to Taichung. Drive along Zhongqing Rd., which becomes Daya Rd. Turn left in the Yingcai Rd. and go alone till you meet Xueshi Rd. CMU is on the corner of Yingcai Rd and Xueshi Rd.
2. Through National Freeway No.3
   (1) Northbound
   Drive along National Freeway No.3, take the exit at Jhongtou Interchange
   (209.0km) and turn to Jhongtou Expressway, which becomes Wuquan S. Rd. Then, go along Wuquan Rd and turn left till you meet Xueshi Rd. CMU is on the corner of Yingcai Rd and Xueshi Rd.

   (2) Southbound
   Drive along National Freeway No.3, take the exit at Shalu Interchange
   (176.1km) and follow the direction to Taichung (Daya). Drive along Zhongqing Rd., which becomes Daya Rd. Turn left in the Yingcai Rd. and go alone till you meet Xueshi Rd. CMU is on the corner of Yingcai Rd and Xueshi Rd.

The Transportation Map.

C. Parking Lots

1. Rehabilitation Medical Building Parking Lot:

The parking is charged at NT$ 50 per hour with accumulation.（B2F.,No.164, Minquan Rd., Central Dist., Taichung City 400, Taiwan，TEL: 04-22248882，FAX:04-22295082）

2. Underground Garage Zhongzheng Park:

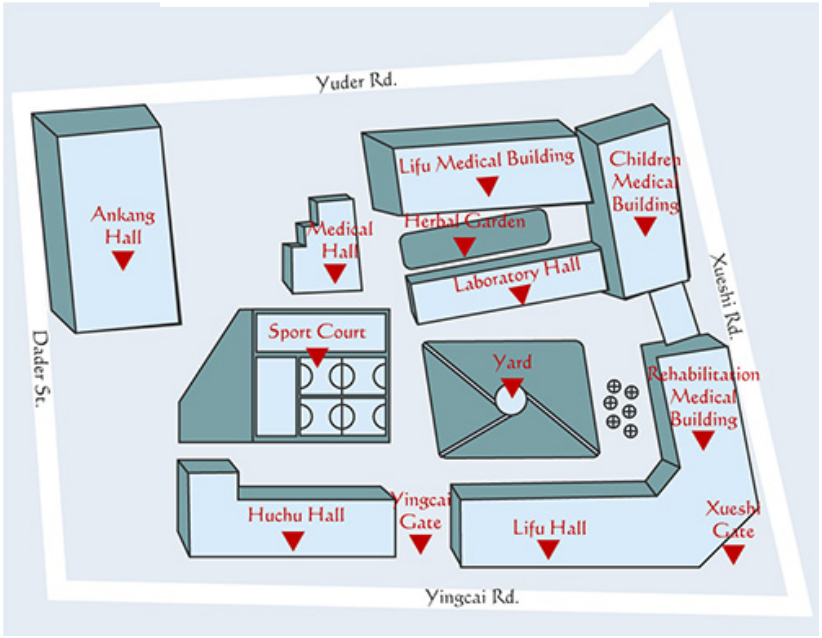
The parking is charged at NT$ 40 per hour with accumulation.（No.108, Xueshi Rd., North Dist., Taichung City 404, Taiwan，TEL:04-22361568，FAX:04-22361116）

3. By Taiwan High Speed Rail

Take a free shuttle bus (Ubus) from Taiwan High Speed Rail at the Exit No. 6. It takes about 40 minutes to get to Zhongshan Hall (China Medical University).

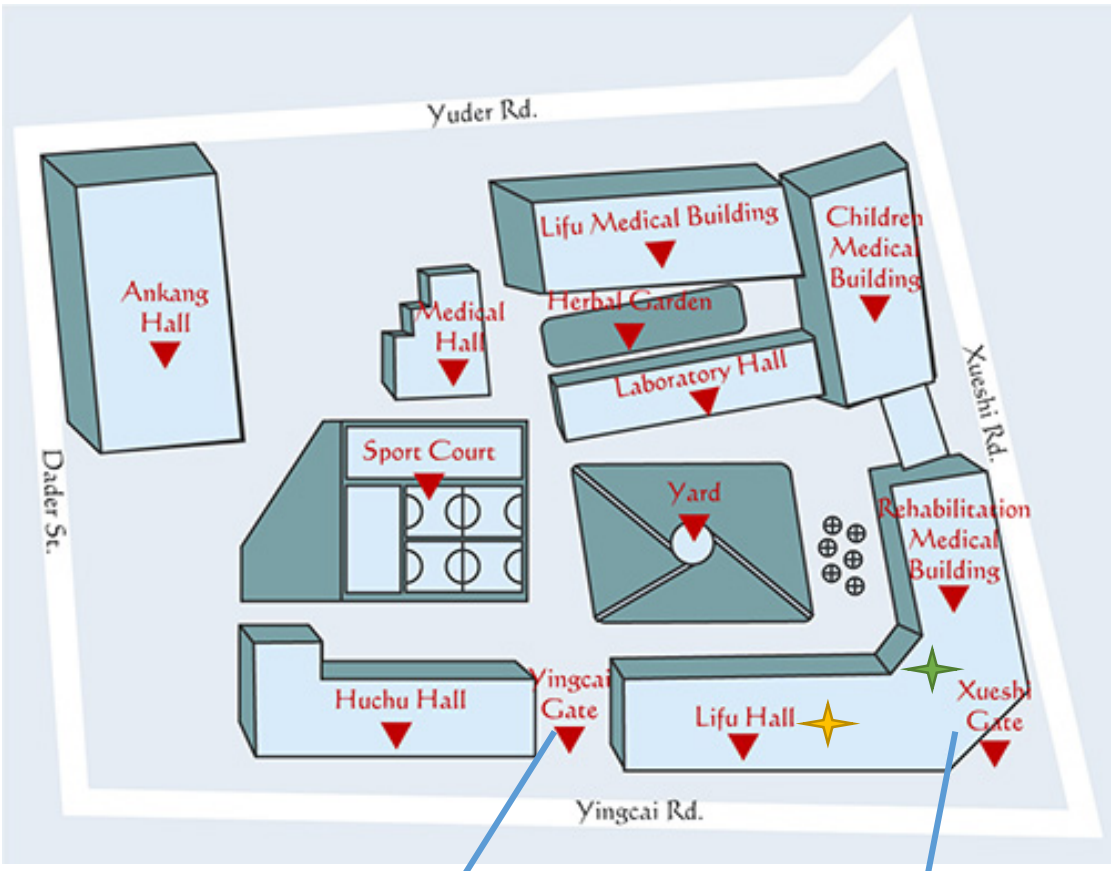
The Building Position

The Taichung Campus Map



IWAAO2015 Transportation :

China Medical University (CMU) campus map



Location:

Seminar: 203 classrooms, 2F in Lifu Hall

Reception: The atrium of Xueshi gate, 2F in Lifu Hall

Banquet: Gourmet Brasserie in The Splendor Hotel

中國醫藥大學(CMU) 校園地圖

地點：

- 會議(Seminar):立夫教學大樓 2 樓 203 教室
- 歡迎晚宴(Reception)： 立夫教學大樓 2 樓學士門中庭

晚宴(Banquet):台中金典酒店 柏麗廳