Announcement

Jan. 21 2019

Dear All,

Everyone is invited to attend the two Meetings. Please register on line for the Workshop which will help us to make a better preparation. The registration fee is NT$1000 for those who has grant of MOST. We also need a lot of chairs for the meetings. Please let us know if you are interested in hosting some sessions of the Meetings. We have a limited support to cover lodging fee and transportation fees for those who do not have any grant. Any suggestions and comments are welcome.

The 7th Trilateral Meeting (Australia-Italy-Taiwan) on Nonlinear PDEs and Applications

Date: Jan. 23 (Wed) 2019 ~ Jan. 28 (Mon) 2019

Venue: Small lecture hall, Ger-Jyh Hall, College of Science, Cheng Kung Campus, NCKU
(國立成功大學成功校區，理化大樓，格致廳小講堂)

Scientific Committee:

Nicola Fusco <n.fusco@unina.it>

Tai-Ping Liu <liu@math.stanford.edu>

Neil Trudinger <Neil.Trudinger@anu.edu.au>

Local Organizer:

Yung-Fu Fang <yffang@mail.ncku.edu.tw>

Ching-Lung Lin <cllin2@mail.ncku.edu.tw>

The 27th Annual Meeting on Differential Equations and Related Topics

Date: Jan. 26 (Sat) 2019 ~ Jan. 27 (Sun) 2019

Date: Jan. 28 (Mon) 2019 , Informal Discussion Day

Venue: Department of Mathematics, National Cheng Kung University (NCKU), Tainan, Taiwan

Local Organizer:

王辰樹 Chern-Shuh Wang <chenshu@mail.ncku.edu.tw>

方永富 Yung-Fu Fang <yffang@mail.ncku.edu.tw>

史習偉 Hsi-Wei Shih <shihhw@mail.ncku.edu.tw>

林景隆 Ching-Lung Lin <cllin2@mail.ncku.edu.tw>

陳旻宏 Min-Hung Chen <chen0499@mail.ncku.edu.tw>

林敏雄 Matthew Lin <mhlin@mail.ncku.edu.tw>

Website: http://www.ncts.ntu.edu.tw/events_2_detail.php?nid=210
http://www.math.ncku.edu.tw/news/news.php
http://www.math.ncku.edu.tw/~fang/

Online Registration: https://goo.gl/forms/ToLtgwHU5KR1xwlv2

Hotel Informations:

Zenda Suites (成大會館)
(On Campus) (Single NT$2800 per night, Double NT$3600 per night)
Address: No.2, Dasyue Rd., East District. Tainan City 701, Taiwan.
Tel \ +886-6-275-8999 Fax \ +886-6-209-3567
http://www.zendasuites.com.tw/en/about.php

GuangHaw Hotel (光華商務飯店)
(15 minutes walk) (Single NT$1200 per night, Double NT$1600 per night)
Address: No. 155 Sec. 1, Beimen Road, West Central Dist., Tainan city 700 Taiwan
Tel: +886-6-226-3171
Email: only4utw@gmail.com
http://www.guanghaw.com.tw

Dynasty Hotel (新朝代大飯店)
(20 minutes walk) (Single NT$1800 per night, Double NT$2400 per night) (online reservation)
Address: No. 46 Cheng Kung Road, North District, Tainan 704
Email: tndynasty@dynastyhotel.com.tw
Tel: 06 225 8121

The 7th Trilateral Meeting (Australia-Italy-Taiwan) on Nonlinear PDEs and Applications

January 23-28, 2019

Venue: **Small lecture hall, Ger-Jyh Hall, College of Science**
National Cheng Kung University (Cheng Kung Campus)

國立成功大學，成功校區，理化大樓，格致廳小講堂

Website: http://www.ncts.ntu.edu.tw/events_2_detail.php?nid=210
http://www.math.ncku.edu.tw/news/news.php

On-Line Registration: https://goo.gl/forms/ToLtgwHU5KR1xwlv2

Speakers from Australia:
Julie Clutterbuck, Monash University
Daniel Daners, University of Sydney
Yihong Du, University of New England
Xuan Duong, Macquarie University
Ramiro Lafuente, University of Queensland
Zihua Guo, Monash University
Jiakun Liu, University of Wollongong
Neil Trudinger, Australian National University

Speakers from Italy:
Stefano Bianchini, SISSA, Trieste:
Lucio Boccardo, University of Roma 1:
Piermarco Cannarsa, University of Roma 2:
Nicola Fusco, University of Napoli
Giuseppe Mingione, University of Parma:
Massimiliano Morini, University of Parma:
Aldo Pratelli, University of Erlangen-Nurnberg

Speakers from Taiwan:
Chiun-Chuan Chen, National Taiwan Univ.
Volker Elling, Academia Sinica
Hsin-Yuan Huang, National Chiao Tung Univ.
Jin-Cheng Jiang, National Tsing Hua Univ.
Jenn-Nan Wang, National Taiwan Univ.
Kung-Chien Wu, National Cheng Kung Univ.
Shih-Hsien Yu, National Univ. of Singapore

Scientific Committee:
Neil Trudinger, Australian National University
Nicola Fusco, University of Napoli
Tai-Ping Liu, Sinica & Stanford University

Organizers:
Yung-fu Fang, National Cheng Kung University
Ching-Lung Lin, National Cheng Kung University

Sponsors:
MOST
National Center for Theoretical Sciences
TWSIAM
National Cheng Kung University
NSCMRPC

The 27th Annual Meeting on Differential Equations and Related Topics

January 26-27, 2019

Venue: **Small lecture hall, Ger-Jyh Hall, College of Science**
National Cheng Kung University (NCKU) (Cheng Kung Campus)

國立成功大學，成功校區，理化大樓，格致廳小講堂

Website: http://www.ncts.ntu.edu.tw/events_2_detail.php?nid=210
http://www.math.ncku.edu.tw/news/news.php

On-Line Registration: https://goo.gl/forms/ToLtgwHU5KR1xwlv2

Plenary Speakers:

Giuseppe Mingione, University of Parma:
Kenji Nakanishi (中西賢次), Kyoto University
Neil Trudinger, Australian National University
Shih-Hsien Yu (尤釋賢), National University of Singapore

Speakers of DE:

Chi-Hin Chan (陳子軒), NCTU
Chueh-Hsin Chang (張覺心), THU
I-Kun Chen (陳逸昆), NTU
John M. Hong (洪盟凱), NCU
Chih-Chiang Huang (黃志強), NTU
Hung-Wen Kuo (郭鴻文), NCKU
Hsin-Yi Lee (李信儀), NCU
Yu-Hao Liang (梁育豪), NUK
Ying-Chieh Lin (林英杰), NUK
Bingying Lu (陸冰瀅), Sinica
Cheng-Fang Su (蘇承芳), NCTU
Ryosuke Takahashi (楊劼之), NCKU
Kuan-Hsiang Wang (王冠祥), NUK

Speakers of Applied Math:

Po-Yuan Chen (陳博源), MDI Center, NCKU
Dean Chou (周鼎贏), NCU
Chia-Yu Hsu (許佳瑜), Feng Chia Univ.
Wei-Qiang Huang (黃韋強), NCTU
Ming-Cheng Shiue (薛名成), NCTU
Maxim Solovchuk, NHRI
Chun-Hao Teng(鄧君豪), NCHU
Yun-Che Wang (王雲哲), NCKU
Mei-Heng Yueh (樂美亨), NTNU
Zhengyang Zhang (張正陽), NTHU

Organizers:

Min-Hung Chen (陳旻宏), NCKU
Yung-Fu Fang (方永富), NCKU
Ching-Lung Lin (林景隆), NCKU
Matthew Lin (林敏雄), NCKU
Hsi-Wei Shih (史習偉), NCKU
Chern-Shuh Wang (王辰樹), NCKU

Sponsors:

MOST
National Center for Theoretical Sciences
TWSIAM
National Cheng Kung University
NSCMRPC

微方年會 24 年感言 撰文：許世壁 (清華大學數系教授 清華大學數系教授)

微分方程年會 (Annual Workshopon Differential Equations)自 1993 年第一次在中正大學舉行 後迄今共 24 年 。當初是由中正大學林長壽教授召集台灣從事微分方程研究專家者提出每舉辦「偏微分方程研討會」，後來經過一番論將常動態系統包括進去名稱 舉辦「偏微分方程研討會」，後來經過一番論將常動態系統包括進去名稱 改為目前的「微分方程研討會」。自改為目前的「微分方程研討會」。自 1993 年迄今，舉辦三次有清大 (1996, 2004, 2014)，二次 的有中正大學 (1993, 2005)，交大 (1994 1 月, 2008)，中研院 (1994 12 月, 2006 1 月)，中央大學 (1997, 2013)，成大 (2001, 2011)，中山大學 (2000, 2016)，其餘的舉辦一次有師範大學 ，其餘的舉辦一次有師範大學 (1998)，中興大學 (1999)，彰師大 (2002)，靜宜大學 ，靜宜大學 (2002 12 月)，南台科技大學 ，南台科技大學 (2006)，高雄 ，高雄大學 (2009)，台大 (2010)，淡江大學 (2012)，台東大學 ，台東大學 (2015)。微方年會有時與國內分析研討會一起辦， (2006 中研院 , 2004 清大)，有時會以國際研討的方式舉辦 (如 1994 年中研院， 暨中曰算子理論聯合研討 2011 年成大)。2004 年在清大微方會，我們藉此機向王懷權 教授退休致最大的敬意，並且將論文收集發表在台灣數學期刊 (2005)。在 2014 年 微方年會，清大同仁藉此機順便祝賀我本人 65 歲生日。目前在台灣數學界從事微分方程研究的人 口是最多 (見下列表格)，其研究成果也有目共睹，多人發表論文在頂尖期刊許同仁得過 國科會的傑出研究獎， 吳大猷數學術年輕家理論中心年青學者 獎, 教育部 學術獎，國家講座中研院的年輕者士等榮譽。

回想我個人在 1979 年 8 月回交大任教，當時從事微分方程研究的人口不多後來由於丘 成桐應用偏微分方程到幾何，才漸漸受到重視。在 1980 年暑假馬利蘭大學劉太平教授在中研院課介紹 Conservation law 及 gas dynamics。記得當時每星期一次，我、鄭國順、林松山從新竹坐巴士到台北圓環，然後搭 305 號公車到南港。那時劉太平提出了一些 open problems 如 nonconvex conservation law，很快就被學物理出身的鄭國順 解決了。做事一向以動作快出名，吃飯、結婚生小孩學問都比般人。而後在 1982 年劉太平 回中研院一年，每星期在交大 舉辦 gas dynamics 的 Seminar，那時參加的人員有鄭國順、林紹雄、林松山及我本人，記得紹講述他在 gas dynamics 的研究，而劉太平也開始做的研究，而劉太平也開始做 Boltzmann equation 的探討，這對他後來在 Boltzmann equation 的研究有很大幫助。 劉院士 在 2006 年返台致力於培育青人研究雙曲型偏微分方程。

1987 年暑假 應清大王懷權 教授之邀請，明尼蘇達大學倪維教授 在清大講述 Semilinear Elliptic Equations，其內容涵蓋 ，其內容涵蓋 Semilinear Dirichlet Problems, Semilinear Neumann Problems, Semilinear Elliptic Equatons on R^n，討論的問題有 patternformation (Spiky pattern), Lane-Emden equations, Conformal scalar curvature equations。倪維明有系統地介紹橢圓型偏微分方程與台灣 數學界，而且留下了一本經典之作「 Some Aspects of Semilinear Elliptic Equation」。直到目前為止，許多人從念這本講義開始學偏微分方程，為了感謝倪維明對台灣發展的貢獻，數學會於 2009 年頒發特殊貢獻獎與倪教授。

中華民國數學會 電子報第 27 期

另一位台灣微分方程發展的重要人物是林長壽教授。早年研究幾何學局部 等距嵌入問題出名 。林教授自 1987 年回台大任教 ，1990 年轉至中正大學 ，閉門研究 “肥皂 泡現象 ” 的偏微分方程有重大突破為國內外數學界肯定 。1997 林教授 擔任首任國家理論科學中心主任 ，推動國內數學的發展有很大貢獻 。而後於 2006 年返回台大任教，創立數學科中心 (TIMS)，高等應用科學中心 ，高等應用科學中心 (CAST)，林教授與其合作者陳俊全發表一系列文章在頂尖數學期刊研究 Conformal Scalar Curvature equation。近年來執行科技部攻頂計畫，研究非線性偏微分方程應用於解決數論、代幾何的問題， 同時也 培育許多國內外偏微分方程的人才。

台灣微分方程界參與許多國際交流學術活動 。1985 年在交大舉辦中美 PDE 研討會 ，美方由劉太平

擔任團長，團員有丘成桐，Nirenberg, Glimm, Rabinowitz, Stroock 等國際知名學者。 這是一個非常不對稱的研討會，我們很幸運地能跟當時 頂尖的數學家接觸，包括一起去中橫觀光，享受解決道路坍方的樂趣 ；1990 年在中研院舉辦第一屆中日偏微分方程討會，

1994 年我代表台灣向日本交流協會申請舉辦中日偏微分方程研討會。研討會在京都舉行，台灣代表有劉太平、倪維明、林長壽、鄭國順、林松山、郭忠勝、王慶安、王懷權、王信華、黃子偉，日方代表以 Mimura 為首 。這是一個非常正式的研討會，台灣的亞東協會及日本交流協會皆有外交代表在國宴致詞。從這以後台日交流頻繁，譬如每年春天台日輪流主辦年青數學家研討會，雙方的碩士生、博士生、博士後研究人員能在一起切磋。為了感謝 Mimura 教授努力推動雙方交流 ,數學會 於 2008 年頒 給他特殊貢獻獎 ；法國是歐洲家中與台灣交流 最多的國家 。早在 1982 年大 Lions, Brezis 及 Temam 應法國在台協會之邀請訪問灣 應法國在台協會之邀請訪問灣 ，台灣與法國在 1988 年首次由王懷權教授在清大主辦 台法微方研討會。1992 年我方組團到巴黎。直到目前台法交流持續進行，由林長壽院士、郭忠勝教授主持；台灣、澳洲、義大利有三邊方程研討會 ，開始由郭紅珠 、Trudinger 辦台灣、澳洲研討會，目前三 邊研討會是由劉太平院士主導 。

微分方程是一門具有強大生命力的領域，許多問題源自於物理、工及幾何 學。從 1980 年至現在 2015 年， 35 年的期間台灣在微分方程研究有長足進步。國內兩位院士劉太平與林長壽在他們的研究領域居國際導地位，而且也為內年輕人培育工作付出時間與心血。希望未來辛苦建立的國際名聲能繼續傳承下去。

微分方程研討年會歷年舉辦地點

第 1 屆 1993 中正大學 第 2 屆 1994 交通大學
第 3 屆 1994-12 月 中央研究院（與中日算子理論聯合研討會一併舉行）
第 4 屆 1996 清華大學 第 5 屆 1997 中央大學 第 6 屆 1998 師範大學
第 7 屆 1999 中興大學 第 8 屆 2000 中山大學 第 9 屆 2001 成功大學
第 10 屆 2002 彰化師範大學 第 11 屆 2002－12 月 靜宜大學
第 12 屆 2004 清華大學（與分析研討會一併舉行） 第 13 屆 2005 中正大學
第 14 屆 2006 中央研究院（與分析研討會一併舉行） 第 15 屆 2006-12 月 南台科技大學
第 16 屆 2008 交通大學 第 17 屆 2009 高雄大學 第 18 屆 2010 台灣大學
第 19 屆 2011 成功大學 第 20 屆 2012 淡江大學 第 21 屆 2013 中央大學
第 22 屆 2014 清華大學 第 23 屆 2015 臺東大學 第 24 屆 2016 中山大學
第 25 屆 2017 交通大學 第 26 屆 2018 台灣大學
第 27 屆 2019 成功大學 第二十七屆微分方程及相關主題年會
第 28 屆 2020 中央研究院 (Academia Sinica) 第 29 屆 2021 中興大學

台灣、澳洲、義大利有三邊方程研討會

- 1st Trilateral Meeting in Taipei, Taiwan, 2000
- 2nd Trilateral Meeting in Murramarang, Australia, 2003
- 3rd Trilateral Meeting in Rome, Italy, 2006
- 4th Trilateral Meeting in Taipei, Taiwan, 2009
- 5th Trilateral Meeting in Wollongong, Australia, 2012
- 6th Trilateral Meeting in Parma, Italy, 2015
- 7th Trilateral Meeting in Tainan, Taiwan, 2019

The 7th Australia-Italy-Taiwan Trilateral Meeting on Partial Differential Equations and Applications

The 7th Trilateral Meeting (Australia - Italy - Taiwan) on Nonlinear PDEs and Applications & The 27th Annual Meeting on Differential Equations and Related Topics,

Jan. 23 (Wed) 2019 ~ Jan. 28 (Mon) 2019

Venue: Small lecture hall, Ger-Jyh Hall, College of Science, NCKU, Tainan, Taiwan

會場：成大，成功校區，格致廳，小講堂

Program

The 7th Trilateral Meeting (Australia-Italy-Taiwan) on Nonlinear PDEs and Applications

Wednesday (01/23)		Thursday (01/24)		Friday (01/25)	
0810~0830	Registration				
0830~0900	Opening Ceremony President Jenny Su Tai-Ping Liu Nicola Fusco				
Chair:	Nicola Fusco	Chair:	Shin-Hwa Wang	Chair:	Tai-Ping Liu
0900~0950	**Lucio Boccardo**	0900~0950	**Yihong Du**	0900~0950	**Nicola Fusco**
0950~1010	Break	0950~1010	Break	0950~1010	Break
Chair:	B	Chair:	Haitao Wang	Chair:	J
1010~1100	**Xuan Duong**	1010~1100	**Stefano Bianchini**	1010~1100	**Zihua Guo**
1110~1200	**Aldo Pratelli**	1110~1200	**Kung-Chien Wu**	1110~1200	**Volker Elling**
1200~1400	Lunch	1200~1400	Lunch	1200~1400	Lunch
Chair:	Kuo-Chang Chen	Chair:	G	Chair:	K
1400~1450	**Piermarco Cannarsa**	1400~1450	**Massimiliano Morini**	1400~1450	**Daniel Daners**
1500~1550	**Chiun-Chuan Chen**	1500~1550	**Jenn-Nan Wang**	1500~1550	**Jin-Cheng Jiang**
1550~1610	Break	1550~1610	Break	1550~1610	Break & Group Photo
Chair:	D	Chair:	H	Chair:	John M. Hong
1610~1700	**Jiakun Liu**	1610~1700	**Julie Clutterbuck**	1610~1700	**Hsin-Yuan Huang**
1710~1800	**Ramiro A. Lafuente**	1710~1800		1710~1800	
	Buffet		上海小籠湯包	1820~	三采日式料理

Saturday (01/26)

The 27th Annual Meeting on Differential Equations and Related Topics

0830~0850 Registration

0850~0900 Opening Ceremony: Sze-Bi Hsu

Chair:	Sze-Bi Hsu
0900~0950	**Kenji Nakanishi**

0950~1010 Break

Chair:	Chang-Hong Wu
1010~1050	**John M. Hong**
1100~1130	**Chih-Chiang Huang**
1140~1220	**Hung-Wen Kuo**

0950~1010 Break

Chair:	Juan-Ming Yuan
1010~1050	**Ming-Cheng Shiue**
1055~1135	**Mei-Heng Yueh**
1140~1220	**Chia-Yu Hsu**

1210~1400 Lunch

1220~1400 Lunch

Chair:	P
1400~1450	**Shih-Hsien Yu**

1450~1510 Break

Chair:	Jen-Hsu Chang
1510~1550	**Chi-Hin Chan**
1600~1630	**Chueh-Hsin Chang**

Group Photo

Break

Chair:	
1510~1550	**Maxim Solovchuk**
1550~1630	**Wei-Qiang Huang**

Group Photo

Break

1630~1650 Break

Chair:	Shih-wei Chou
1650~1720	**I-Kun Chen**
1730~1800	**Yu-Hao Liang**

1630~1650 Break

Chair:	Chi-Tien Lin
1650~1720	**Zhengyang Zhang**
1720~1800	**Po-Yuan Chen**

1830~ Banquet 雨荷舞水

Sunday (01/27)

Chair:	U
0900~0950	**Giuseppe Mingione**

0950~1010 Break

Chair:	Chun-Kong Law
1010~1050	**Ying-Chieh Lin**
1100~1130	**Cheng-Fang Su**
1140~1210	**Bingying Lu**

0950~1010 Break

Chair:	Chin-Tien Wu
1010~1050	**Yun-Che Wang**
1050~1130	**Dean Chou**
1140~1220	**Chun-Hao Teng**

1210~1400 Lunch

1220~1400 Lunch

Chair:	X
1400~1450	

1450~1510 Break

Chair:	Bo-Chih Huang
1510~1550	**Ryosuke Takahashi**
1600~1630	**Hsin-Yi Lee**
1630~1700	**Kuan-Hsiang Wang**
1700~1800	**Neil Trudinger, Tai-Ping Liu,**

Break

Chair:	Z
1510~1550	
1550~1630	
1650~1730	

Monday(01/28)

Chair:	Informal Discussion
0900~0950	

0950~1010

Chair:	Informal Discussion
1010~1050	
1050~1130	
1140~1220	

1220~1400

Chair:	Informal Discussion
1400~1450	
1510~1550	
1550~1630	
1650~1730	
1730~1810	

阿裕牛肉

The 7th Trilateral Meeting (Australia - Italy - Taiwan) on Nonlinear PDEs and Applications

and

The 27th Annual Meeting on Differential Equations and Related Topics,

Date: Jan. 23 (Wed) 2019 ~ Jan. 28 (Mon) 2019

Venue: Ger-Jyh Hall, Small lecture hall, College of Science

National Cheng Kung University (Cheng Kung Campus)

國立成功大學成功校區，理化大樓，格致廳小講堂

Website: http://www.ncts.ntu.edu.tw/events_2_detail.php?nid=210

http://www.math.ncku.edu.tw/news/news.php

http://www.math.ncku.edu.tw/~fang/

Online Registration: https://goo.gl/forms/ToLtgwHU5KR1xwlv2

Title and Abstract:

01/23 (Wednesday)

"Lucio Boccardo" <boccardo@mat.uniroma1.it>, University of Roma 1:

Title : Some elliptic equations with W^{01,1} solutions

Abstract: We consider some nonlinear Dirichlet problems and we study how lower order terms can give a regularizing effect on the solutions: the existence of distributional solutions with minimal properties (solutions in $W^{01,1}$, functional space not so usual for finding solutions of elliptic problems) or finite energy solutions, even with nonregular data.

"Xuan Duong" <xuan.duong@mq.edu.au>, Macquarie University

Title: Dispersive estimates for self-adjoint operators

Abstract: Let *X* be a metric space with a doubling measure satisfying μ(B) $\gtrsim r_B^n$ for any ball *B* with radius r_B. Let *L* be a non negative self-adjoint operator on $L^2(X)$. We assume that the semigroup e^{-tL} satisfies a Gaussian upper bound and that the flow e^{itL} satisfies a typical $L^1 - L^\infty$ dispersive estimate of the form

$$\|e^{itL}\|_{L^1 \to L^\infty} \lesssim |t|^{-\frac{n}{2}}$$

Then we prove a similar $L^1 - L^\infty$ dispersive estimate for a general class of flows $e^{it\phi(L)}$, with $\phi(r)$ of power type near 0 and near ∞. In the case of fractional powers $\phi(L) = L^\nu$, ν ∈ (0,1), we deduce dispersive estimates for e^{itL^ν} with data in Sobolev, Besov, or Hardy spaces H_L^p with p ∈ (0,1], associated to the operator *L*. This is a joint work with The Anh Bui, Piero D'Ancona and Detlef Müller.

"Aldo Pratelli" <pratelli@math.fau.de>, University of Erlangen-Nurnberg

Title: On the isoperimetric problem with double density in R^N.

Abstract: We will discuss about the isoperimetric problem in R^N with double density. This means, one aims to minimize the perimeter of sets of given volume, but volume and perimeter are given by the integral of two different functions, called densities, over the set and its boundary respectively. As usual, the main questions are existence and regularity of minimizers. This problem has been deeply studied in the last decades, because of some interesting applications. The problem has primarily been studied with a single density, but the case of two different ones is particularly important, specially when the density of the perimeter also depends on the direction of the boundary. In this talk, we will give an overview of the main classical results and open questions, and we will concentrate on some recent developments. Parts of the talk are based on several joint papers with De Philippis, Franzina, Jachan, Morgan, Saracco.

"Piermarco Cannarsa" <cannarsa@mat.uniroma2.it>, uniroma2

Title: Mean field games with state constraints

Abstract: This talk will address deterministic mean field games for which agents are restricted in a closed domain of Euclidean space. In this case, the existence, uniqueness, and regularity of Nash equilibria cannot be deduced as for unrestricted state space because, for a large set of initial conditions, the uniqueness of solutions to the minimization problem which is solved by each agent is no longer guaranteed.
We will therefore attack the problem by considering a relaxed version of it, for which the existence of equilibria can be proved by set-valued fixed point arguments. We will then give a uniqueness result for such equilibria under a classical monotonicity assumption. Finally, we will analyze the regularity of the relaxed solution and show that it satisfies the typical first order PDE system of mean field games.

"(陳俊全) Chiun-Chuan Chen" <chchchen@math.ntu.edu.tw>, National Taiwan University

Title: A total mass estimate for the diffusive Lotka–Volterra system of competing species
Abstract: Using an elementary approach, we establish a new maximum principle for the diffusive Lotka–Volterra system of competing species in 1-dim case, which involves pointwise estimates of an elliptic equation consisting of the second derivative of one function, the first derivative of another function, and a quadratic nonlinear term. This maximum principle gives an a priori estimate for the total mass of the species in a traveling wave solution. Applying this estimate to the system of three competing species leads to a nonexistence theorem of traveling wave solutions.

"Jiakun Liu" <jiakunl@uow.edu.au>, University of Wollongong

Title: A boundary value problem for Monge-Ampere equations.
Abstract: In this talk, we will present a recent result on the global $C^{2,\alpha}$ and $W^{2,p}$ regularity for the Monge-Ampere equation subject to a natural boundary condition arising in optimal transportation. This is a joint work with Shibing Chen and Xu-Jia Wang.

"Ramiro A. Lafuente" <r.lafuente@uq.edu.au>, University of Queensland,

Title: Homogeneous Einstein manifolds via a cohomogeneity-one approach
Abstract: We establish non-existence results on non-compact homogeneous Einstein manifolds. The key idea in the proof is to consider non-transitive group actions on these spaces (more precisely, actions with cohomogeneity one), and to find geometric monotone quantities for the ODE that results from writing the Einstein equation in such a setting. As an application, we show that homogeneous Einstein metrics on Euclidean spaces are Einstein solvmanifolds. This is joint work with C. Bhm.

01/24 (Thursday)

"Yihong Du" <ydu@une.edu.au>, University of New England

Title: The Dynamics of a Fisher-Kpp Nonlocal Diffusion Model with Free Boundaries
Abstract: We introduce and discuss a class of free boundary models with "nonlocal diffusion", which are natural extensions of the free boundary models considered by Du and Lin [SIAM J. Math. Anal., 2010] and elsewhere, where "local diffusion" is used to describe the population dispersal, with the free boundary representing the spreading front of the species. We show that this nonlocal problem has a unique solution de fined for all time, and then examine its long-time dynamical behavior when the growth function is of Fisher-KPP type. We demonstrate that a spreading-vanishing dichotomy holds, though for the spreading-vanishing criteria significant differences arise from the well-known local diffusion model.

"Stefano Bianchini" <bianchin@sissa.it>, SISSA, Trieste:

Title: A decomposition of vector fields in $\mathbb{R}^{d+1}$

Abstract:
Given a vector field $\rho(1,\mathbf{b}) \in L^1_{loc}(\mathbb{R}^+ X \mathbb{R}^d,\ \mathbb{R}^{d+1})$ such that $div_{t,x}(\rho(1,\mathbf{b}))$ is a measure, we consider the problem of uniqueness of the representation η of $\rho(1,\mathbf{b})\,\mathcal{L}^{d+1}$ as a superposition of characteristics γ: $(t_\gamma^-, t_\gamma^+) \to \mathbb{R}^d$, $\gamma'(t) = \backslash b(t,\gamma(t))$. We give conditions in terms of a local structure of the representation η on suitable sets in order to prove that there is a partition of $\mathbb{R}^{d+1}$ into disjoint trajectories P_a, $a \in \mathcal{A}$, such that the PDE

$$div_{t,x}(u\,\rho(1,\mathbf{b})) \in M(\mathbb{R}^{d+1}), \qquad u \in L^\infty(\mathbb{R}^+ X \mathbb{R}^d),$$

can be disintegrated into a family of ODEs along P_a with measure r.h.s.. The decomposition P_a is essentially unique. We finally show that $\mathbf{b} \in L^1_t(BV_x)_{loc}$, particular, the renormalization property for nearly incompressible *BV* vector fields.

"(吳恭儉)Kung-Chien Wu" < kcwu@mail.ncku.edu.tw>, National Cheng Kung University

Title: Spatial behavior of the solution to the Boltzmann equation with hard potentials

Abstract: The main goal of this talk is to understand the quantitative spatial decay of the solution to the Boltzmann equation with hard potentials for both linear and nonlinear problems.
For the nonlinear study, we get the spatial behavior by using the nonlinear weighted energy estimate. For the linear study, we get the quantitative space-time behavior under some slow velocity decay assumption, but without regularity assumption on the initial data. Both results reveal that hard sphere and hard potential models differ in their spatial behaviors. This is a joint work with Yu-Chu Lin and Haitao Wang.

"Massimiliano Morini" <morini73@gmail.com>, <massimiliano.morini@unipr.it>, University of Parma

Title: Existence and uniqueness for anisotropic and crystalline mean curvature flows

Abstract: An existence and uniqueness result, up to fattening, for crystalline mean curvature flows with forcing and arbitrary (convex) mobilities, is proven. This is achieved by introducing a new notion of solution to the corresponding level set formulation. Such solutions satisfy a comparison principle and stability properties with respect to the approximation by suitably regularized problems. The results are valid in any dimension and for arbitrary, possibly unbounded, initial closed sets. As a result of our analysis, we deduce the convergence of a minimizing movement scheme proposed by Almgren, Taylor and Wang (1993), to a unique (up to fattening) “flat flow”.

"(王振男)Jenn-Nan Wang" <jnwang@math.ntu.edu.tw>, National Taiwan University

Title: Quantitative unique continuation for the fractional Schrödinger operator
Abstract: In this talk, I would like to discuss some quantitative uniqueness estimates related to the strong unique continuation property and the unique continuation at infinity for the fractional Schrödinger operator. These kinds of estimates are useful in understanding the local properties of the solution. For the classical Schrödinger operator, these estimates have been extensively studied and successfully applied to other problems. Recently, the study of the local properties of solutions to the fractional equation became possible thanks to the Caffarelli-Silvestre extension theorem. For the fractional Schrödinger operator, we are especially interested in the dependence of the estimates on the size of the potential. Besides of mathematical interests, fractional equations arise naturally from super-diffusion and can be used in modeling a lot of physical phenomena involving long jumps.

"Julie Clutterbuck" <julie.clutterbuck@monash.edu>, Monash University

Title: "The shape of the ground state for the Robin eigenvalue problem".
Abstract:
We consider the first eigenfunction of the Laplace operator with Robin boundary values. In the case of Neumann boundary values, the first eigenfunction is constant. In the case of Dirichlet boundary values, the first eigenfunction is log-concave. The Robin case is often considered to interpolate between these two, and so it is reasonable to ask whether the first Robin eigenfunction is also log-concave. We show that in general it is not, and classify the limited situations in which it is. This is joint work with Ben Andrews and Daniel Hauer.

01/25 (Friday)

"Nicola Fusco" <n.fusco@unina.it>, University of Napoli:

Title: Asymptotic stability of the gradient flow of nonlocal energies
Abstract: I will discuss short time existence and long-time stability of a class of equations modeling the evolution of the interface between an elastic material and a material void, controlled by mass diffusion within the surface. These equations appear as the H^{-1}-gradient flow of an energy given by the sum of the area of the interface plus a nonlocal volume term. Our stability results are new even in the simplest case of the surface diffusion equation.

"Zihua Guo" <zihua.guo@monash.edu>, Monash University

Title: Scattering for the 3D Gross-Pitaevskii equation
Abstract: We study the Cauchy problem for the 3D Gross-Pitaevskii equation. Global well-posedness in the natural energy space was proved by Gerard.
We prove scattering for small data in the same space with some additional angular regularity, and in particular in the radial case we obtain small energy scattering. The crucial ingredients are new generalized Strichartz estimates and some new observed "NULL" structures of the Gross-Pitaevskii equation after some normal form type transform. This is a joint work with Zaher Hani and Kenji Nakanishi.

"Volker Elling" <velling@math.sinica.edu.tw>, Sinica

Title: Vortex cusps
Abstract: Vortex cusps are pairs of vortex sheets with opposite circulation that merge in a cusp. Such solutions are observed in engineering flows, for example vortex sheets in Mach reflection at a solid wall. We present modelling and numerics of vortex cusps, calculate the cusp exponent and discuss possible rigorous existence proofs.

"Daniel Daners" <daniel.daners@sydney.edu.au>, University of Sydney,

Title: Degenerate periodic-parabolic evolution equations of logistic type
Abstract: We consider periodic-parabolic evolution equations with a logistic nonlinearity allowing spacial and temporal degeneration as a parameter becomes large. We characterize the existence and stability of positive periodic-parabolic solutions with the help of a parabolic maximum principle on non-cylindrical domains. This is joint work with Julian Lopez-Gomez.

"(江金城) Jin-Cheng Jiang" <jcjiang@math.nthu.edu.tw>, National Tsing Hua University

Title: On the Cauchy problem for the Boltzmann equation
Abstract: In this talk, we will present some recent progress on the Cauchy problem for the Boltzmann equation. We will begin with the introduction of the Boltzmann equation, its connection with fluid dynamics. Then the result of the local well-posedness for the Cauchy problem of the non-cutoff Boltzmann equation in the weighted Sobolev space will be presented. The quasi-linear method instead of linearization method is used to prove the existence and the non-negativity of the solution.

"(黃信元)Hsin-Yuan Huang" <hyhuang@math.nctu.edu.tw>, National Chiao Tung University

Title: On the Bubbling Solutions to the Liouville System
Abstract: In this talk, I will briefly introduce the recent developments on the Liouville system. The system is related to several models of Chemistry, Ecology and Physics. My recent result on the bubbling solutions will be present.

==========

The 27th Annual Meeting on Differential Equations and Related Topics

01/26 (Saturday)

Plenary Talks:
"Kenji Nakanishi" <kenjinakanishi@gmail.com>, Kyoto University

Title: Randomized final data problem for the nonlinear Schrödinger and the Gross-Pitaevskii equations
Abstract: This is based on joint work with Takuto Yamamoto. We study large time behavior of solutions to the nonlinear Schrodinger equations with power-type interactions. For powers between the mass critical and the Fujita exponents, there exists a global solution asymptotic (at time infinity) to any free solution of finite mass in three or higher space dimensions. A scaling argument suggests that the uniqueness is a super-critical problem beyond the reach of standard perturbation arguments. Randomizing the final state, however, Murphy proved that one can almost surely find a unique asymptotic solution in a certain function space, if the power is above the Strauss exponent.

In this talk, it is shown that we can go slightly below the Strauss exponent by using another function space. In particular, it allows us to treat quadratic interactions in three space dimensions, which often appears in physical models. The same argument applies to the asymptotic form consisting of a plane wave and a linearized dispersive wave with finite energy for the defocusing cubic equation.

Differential Equations:

"P-洪盟凱 John M. Hong" <jhong@math.ncu.edu.tw>, National Central University

Title: The Global Escape Phenomenon of Transonic Gas-like Fluids with Self-gravitation in Spherically Symmetric Space-times.
Abstract: In this talk, the global escape phenomenon of gas-like transonic fluids with self-gravitation in Spherically symmetric space-times is studied. The escape phenomenon is governed by an initial-boundary problem of one-dimensional compressible Euler-Poisson equations which form a mixed-type nonlinear partial differential system of balance laws. The compressible Euler-Poisson system is reformulated as a 3 _ 3 hyperbolic system of balance laws by the equations of fluid's density and the gravitational potential. The

global existence to the shock wave solutions of fluid's density-momentum and the Lipschitz continuous solution to the gradient of potential, is established by a new version of generalized Glimm scheme (GGS for short). The new approximate solutions of generalized Riemann and boundary-Riemann problems, which are the building block of GGS, are constructed by the de-coupling process of fluid's quantities and potential's gradient. For the global boundedness of approximate solution by GGS, the key conditions to the momentum and potential's gradient on the boundary are provided. Finally, the modified wave interaction estimates are shown for the decay of Glimm functionals, which leads to the global existence of solutions.

"PD-黃志強 Chih-Chiang Huang" <loveworldsteven@hotmail.com>, NCTS

Title: Traveling waves for the FitzHugh-Naumo system with monostable or bistable nonlinearity
Abstract: In this talk, we will study the FitzHugh-Naumo system (FHN) with monostable and bistable nonlinearity, respectively. We also consider steady states of (FHN) in a bounded domain and traveling waves of (FHN) in a cylinder. By a variational method, we would like to construct traveling waves for a scalar equation and generalize this approach to an equation with a nonlocal term arising from the FitzHugh-Nagumo system (FHN). In addition, Turing patterns for (FHN) are discussed in the talk. This is a joint with Chiun-Chuan Chen and Chao-Nien Chen.

"AP-郭鴻文 Hung-Wen Kuo" <hwkuo@mail.ncku.edu.tw>, National Cheng Kung University

Title: Singularity of Free Molecular Flow in Bounded Domains
Abstract: We study the singularity of free molecualr flow in the spherical symmetric domains. First, we show the singularities caused by the effects of the specular reflection boundary condition and the diffuse reflection boundary condition. Then we try to study whether the solution is smooth upon imposing some suitable conditions on initial data.

Applied Math:

"AP-薛名成 Ming-Cheng Shiue" <mshiue@math.nctu.edu.tw>, National Chiao Tung University
Title: Data assimilation algorithms based on Synchronization of truth and models
Abstract: In this talk, we first recall continuous and discrete data assimilation algorithms that were proposed for designing finite-dimensional feedback controls for 2D Navier-Stokes equations. Then, two new nudging methods, hybrid nonlinear and delay-coordinate nudging are considered and studied.
In the first part, hybrid nonlinear continuous data assimilation algorithms for Lorenz systems will be studied and presented. It is shown that the approximate solutions converge to the unknown reference solutions over time provided that the first or second variable of Lorenz systems is synchronized. This is a joint work

with Yi Juna Du.
In the second part, two new continuous and discrete data assimilation algorithms for two-dimensional Navier-Stokes equations are presented and studied. The explicit use of present and past observations at each time step provides a way that new methods might outperform the old one, which was successfully tested for Lorenz 96 model.
In this talk, we will give preliminary results that provide sufficient conditions on the finite-dimensional spatial resolution of the collected data and observational measurements to make sure that the approximate solutions obtained from the new algorithms converge to the unknown reference solutions over time.

"aP-樂美亨 Mei-Heng Yueh" <yue@ntnu.edu.tw>, National Taiwan Normal University

Title: Computational Conformal Geometry with Applications
Abstract: Computational conformal geometry is an interdisciplinary field based on the theories of conformal geometry as well as computational algorithms. It has been widely applied to carry out 3D image processing tasks, such as surface resampling, remeshing, registration, rendering, and alignment. Especially when the geometry is complicated, a suitable parameterization of the surface can be used to simplify the shape of the domain. In this talk, I will introduce my recent works on the computation of surface parameterizations, and demonstrate some applications on computer graphics and visualization of medical images.

"aP-許佳璵 Chia-Yu Hsu" <cyuhsu@fcu.edu.tw>, <chiahsutw@gmail.com>, Feng Chia University

Title: The Strategy for Schooling Pattern of Lampreys
Abstract: The numerical computational solutions for schooling of lampreys' swimming under some specific conditions, such as spacing in between fishes and initial body activation waves pattern next to or in front each one, are presented in this talk. The schooloing pattern [1] in marine ecology is a common migration pattern for fishes of different swimming styles, such as carangiform of makrells, subcarangiform of salmonids or anguiliform of eels [2]. In particular, to school is one strategy to reduce energy consumption during migration [3], not to mention, to survival from predators [4]. In this talk, a model of multiple anguiliform swimmers, such as lamprey, is created to simulate the schooling pattern. The adaptive mesh refinement immersed boundary method is used to solve the numerical solution for the simulations. Moreover, is there possibility of synchronized schooling for paralleled multi-swimmers or what is the strategy to have the schooling pattern stabilized? Those are questions will be discussed in this talk.
Keywords: lamprey, schooling pattern, adaptive mesh refinement immersed boundary method
[1]A.D. Becker, H. Masoud, J. W. Newbolt1, M. Shelley, L. Ristroph1, Hydrodynamic schooling of flapping swimmers, Natural Communication, (2015), 1-8
[2]Eric D. Tytell, The hydrodynamics of eel swimming, II. Effect of swimming speed, J. of

Exp. Biol., 207 (2004), 3265-3279.
[3]E. Burgerhout , C. Tudorache, S. A. Brittijn , A. P. Palstra , R. P. Dirks, G. E.E.J.M. van den Thillart , Schooling reduces energy consumption in swimming male European eels, Anguilla anguilla L. J. Exp. Mar. Bio. and Eco. 448 (2013) 66–71
[4] T. Oboshi, S. Kato, A. Mutoh, H. Itoh, A simulation study on the form of fish schooling for escape from predator, CiNii,(2003), 18, 119-131

Plenary Talks:

"P-(尤釋賢) Shih-Hsien Yu", <matysh@nus.edu.sg>, National University of Singapore

Title: Heat equation with Bounded Variation heat conductivity
Abstract: In this talk, a new constructive procedure to establish the Green's function for heat equation with a BV function heat conductivity; and the pointwise structure of the Green's function will be established.

Differential Equations:

"AP-陳子軒 Chi-Hin Chan" <cchan@math.nctu.edu.tw>, National Chiao Tung University

Title: Anti-Thesis to the Stokes paradox on the hyperbolic plane.
Abstract: In this talk, we will discuss a recent result which is due to Chi Hin Chan and Magdalena Czubak in which we proved the existence of a nontrivial Stationary Navier-Stokes flow on an exterior domain of a hyperbolic plane which satisfies both the no-slip boundary condition and the finite Dirichlet norm property. This shows that there is no Stokes paradox in the hyperbolic plane setting.

"aP-張覺心 Chueh-Hsin Chang" <changjuexin@thu.edu.tw>, Tung Hai University

Title: Attractive interaction of 2-species traveling waves for the 3 components competition-diffusion systems
Abstract: In this talk we consider the weak interaction between two traveling wave solutions of the threes-species competition-diffusion systems. Each of the two traveling wave solutions has one trivial component (called trivial waves). By the invariant manifold theory and asymptotic behavior of kernels of linearized operators, we can prove the existence and instability of non-monotonic traveling wave solutions for three-species.
This is a joint work with Prof. Chiun-Chuan Chen and Prof. Shin-Ichiro Ei.

"aP-陳逸昆 I-Kun Chen" <ikun.chen@gmail.com>, National Taiwan University

Title: Propagation of boundary-induced discontinuity in stationary radiative transfer and its application to the optical tomography

Abstract: We consider a boundary value problem of the stationary transport equation with the incoming boundary condition in two or three dimensional bounded convex domains. We discuss discontinuity of the solution to the boundary value problem arising from discontinuous incoming boundary data, which we call the boundary-induced discontinuity. In particular, we give two kinds of sufficient conditions on the incoming boundary data for the boundary-induced discontinuity. We propose a method to reconstruct attenuation coefficient from jumps in boundary measurements.

"aP-梁育豪 Yu-Hao Liang" <yhliang@nuk.edu.tw>, National University of Kaohsiung

Title: The effects of awareness on the epidemic models

Abstract: The rapid advance of technology has brought the communication between individuals more and more accessible and diverse. This also makes people have more chance to be aware of an infectious disease outbreak and hence reduce the risk of infection. In this talk, we will propose an epidemic model by taking into account the influence of awareness. In our model, a multiplex network for which the spreading of the disease and information occurs, respectively, in two different layers of networks, i.e., the physical network and the virtual network. In addition, these two diffusive processes are assumed to interact and affect each other. Some theoretical results on this model will be introduced. This is a joint work with Prof. Jonq Juang.

Applied Math；

"aP-Maxim Solovchuk" <solovchuk@gmail.com>, National Health Research Institutes (NHRI)

Title: A Nonlinear Conservative System for Describing Highly Nonlinear Acoustic Waves in Heterogeneous Media

Abstract: A new system of hyperbolic PDEs capable of describing the nonlinear nature of acoustic fluctuations that propagate over inhomogeneous and heterogeneous fluid media is formulated. This novel system model is initially derived by using the traditional principles of nonlinear acoustics [1], i.e. the finite-amplitude methodology, to yield a general system for describing acoustic fluctuations from the Navier-Stokes-Fourier equations. Here, by incorporating the special substitution technique of [2], it is found that the classical result can be closed into a conservative system of nonlinear PDEs.
However, the resulting system is then found to be in a general form of the conservation laws, namely the capacitive-conservative differential form [3]. A closer look at the Rankine-Hugoniot relations that result from the system's associated flux function indicates that the system model is consistent with the physical expectations inside the acoustic regime. As a result, we extend the high-order shock-capturing numerical

approach used in [4,5] so that the nonlinear nature of the acoustic propagation in heterogeneous fluid media (including shocks) can be captured without numerical artifacts while keeping any numerical dissipation to a minimum. To verify and illustrate the capabilities of the proposed nonlinear system model, one- and two-dimensional benchmark problems of the literature are studied [3,6]. Applications of the proposed system for the simulation of high intensity focused ultrasound treatment of liver cancer will be presented [7].

References

[1] Hamilton, Mark F., and David T. Blackstock, eds. “Nonlinear acoustics”. Vol. 1. San Diego: Academic press, 1998.

[2] Christov, Ivan, C. I. Christov, and P. M. Jordan. “Modeling weakly nonlinear acoustic wave propagation.” The Quarterly Journal of Mechanics & Applied Mathematics 60.4 (2007): 473-495.

[3] LeVeque, Randall J. “Finite volume methods for hyperbolic problems.” Vol. 31. Cambridge university press,2002.

[4] Manuel A. Diaz, Maxim A. Solovchuk, Tony W.H. Sheu. “A Conservative Numerical Scheme for Modeling Nonlinear Acoustic Propagations in Thermoviscous Homogeneous Media.” Journal of Computational Physics, 2018, https://doi.org/10.1016/j.jcp.2018.02.005.

[5] Manuel A. Diaz, Maxim A. Solovchuk, Tony W.H. Sheu, “High-Performance MultiGPU Solver for Describing Nonlinear Acoustic Waves in Homogeneous Thermoviscous Media.” Computers & Fluids, 2018, https://doi.org/10.1016/j.compfluid.2018.03.008.

[6] LeVeque, Randall J. “Wave propagation algorithms for multidimensional hyperbolic systems.” Journal of Computational Physics 131.2 (1997): 327-353.

[7] Solovchuk M, Sheu TW, Thiriet M. Multiphysics modeling of liver tumor ablation by high intensity focused ultrasound. Communications in Computational Physics. 2015 Oct;18(4):1050-71.

“PD-黃韋強 Wei-Qiang Huang” <wqhuang@math.nctu.edu.tw>, National Chiao Tung University

Title: An Integrated Eigensolver for Graph Laplacian Eigenvalue Problem

Abstract: The eigenvalue problem of a graph Laplacian matrix arising from a simple, connected and undirected graph has been given more attention due to its extensive applications in the field of machine learning. The associated graph Laplacian matrix is symmetric, positive semi-definite, and is usually large and sparse. Computing some smallest positive eigenvalues and corresponding eigenvectors is often of interest for either clustering or dimensionality reduction.

However, its singularity makes the classical eigensolvers inefficient since we need to solve related linear systems. Moreover, for large-scaled networks from the real world, such as social media, transactional databases, and sensor systems, there are in general not only local connections. Therefore, it is usually time-consuming, or even unable, to directly find the matrix factorization for solving involved linear systems exactly. In this talk, we propose an inner-outer iterative eigensolver, iSIRA, based on the residual Arnoldi method together with an implicit remedy of the singularity and an effective deflation for convergent eigenvalues. Numerical experiments demonstrate that the integrated eigensolver outperforms the classical methods, especially in the case when the matrix factorization is not available.

"PD-張正陽 Zhengyang Zhang" <zhengyang.zhang@math.nthu.edu.tw>, National Tsing Hua University

Title: A class of state-dependent delay differential equations and applications to forest growth
Abstract: We consider a state-dependent delay differential equation that describes the dynamics of a population of trees in a forest. This model comes from a size-structured population dynamical model. This class of state-dependent delay differential equation is compared with a computer model called SORTIE (which is an individual-based model). The main ingredient taken into account in both models is the competition for light between trees. The comparison suggests that state-dependent delay differential equations can help to understand the dynamics of forest, since we get pretty good fit to the SORTIE model. Therefore it makes sense to analyze the state-dependent delay differential equation. The second and third parts are devoted to the properties of the semi-flow generated by such a state-dependent delay differential equation and the boundedness and dissipativity of the solutions. In the last part, motivated by the nematode destruction in a pine forest, we construct a predator-prey system including the above state-dependent delay differential equation and we present numerical simulations of this system in several cases and scenarios.

"Dr-陳博源 Po-Yuan Chen" <pyrobertchen@gmail.com>, Medical Device Innovation Center, NCKU (成大前瞻醫療器材科技中心)

Title: Quadratic Adaptive Algorithm for Solving Cardiac Action Potential Models
Abstract: In this talk, I will give a short introduction to the numerical simulation of cardiac cell models and present a new adaptive integration method for computing cardiac action potential models. Time steps are adaptively chosen by solving a quadratic formula involving the first and second derivatives of the membrane action potential. To improve the numerical accuracy, we devise an extremum-locator (el) function to predict the local extremum when approaching the peak amplitude of the action potential. In addition, the time step restriction (tsr) technique is designed to limit the increase in time steps, and thus prevent the membrane potential from changing abruptly. The performance of the proposed method is tested using the Luo-Rudy phase 1 (LR1), dynamic (LR2), and human O'Hara-Rudy dynamic (ORd) ventricular action potential models, and the Courtemanche atrial model incorporating a Markov sodium channel model. Numerical experiments demonstrate that the action potential generated using the proposed method is more accurate than that using the traditional Hybrid method, especially near the peak region. The traditional Hybrid method may choose large time steps near to the peak region, and sometimes causes the action potential to become distorted. In contrast, the proposed new method chooses very fine time steps in the peak region, but large time steps in the smooth region, and the profiles are smoother and closer to the reference solution.
In the test on the stiff Markov ionic channel model, the Hybrid blows up if the allowable time step is set to be greater than 0.1 ms. In contrast, our method can adjust the time step size automatically, and is stable. Overall, the proposed method is more accurate than and as efficient as the traditional Hybrid method, especially for the human ORd model. The proposed method shows improvement for action potentials with a non-smooth morphology, and it needs further investigation to determine whether the method is helpful during propagation of the action potential. ----------

01/27 (Sunday)

Plenary Talks:

"Giuseppe Mingione" <rosariomingione@gmail.com>, University of Parma:

Title: Lipschitz estimates for every taste

Abstract: I will focus on gradient estimates for solutions to non-homogeneous, possibly degenerate equations and systems. I will give a survey of results on Lipschitz estimates starting from the uniformly elliptic case, where linear and nonlinear potentials come into the play. I will then switch to the case of non-uniformly elliptic equations, where a new and optimal theory can be developed.

Differential Equations:

"aP-林英杰 Ying-Chieh Lin" <linyj@nuk.edu.tw>, National University of Kaohsiung

Title : Concentration of source terms in generalized Glimm scheme for initial-boundary problem of nonlinear hyperbolic balance laws

Abstract: In this talk, we investigate the initial-boundary value problem for a nonlinear hyperbolic system of balance laws with sources $a_x g$ and $a_t h$. To get the approximate solutions of our problem, we consider a version of generalized Riemann problem that concentrates the variation of a on a thin T-shaped region of each grid. A new version of Glimm scheme is introduced to construct the approximate solutions and its stability is proved by considering two types of conditions on a. Finally, we verify the consistency of the scheme and the entropy inequality to establish the global existence of entropy solutions.

"PD-蘇承芳 Cheng-Fang Su" < scf1204@nctu.edu.tw>, National Chiao Tung University, Taiwan

Title: Incompressible inviscid limit of the viscous two-fluid model on expanding domains with general initial data

Abstract: This talk is about that the incompressible inviscid limit of the viscous two-fluid model on the expanding domains with general initial data in the framework of weak solutions. We prove rigorously that the weak solutions of the compressible two-fluid model converge to the strong solution of the incompressible Euler equations in the time interval provided that the latter exists and the tool is based on the refined relative entropy method. Moreover, thanks to the Strichartz's estimates of linear wave equations, we also obtain the convergence rates. My talk will be based on a joint work with Professor Young-Sam Kwon.

"PD-陸冰瀅 Bing-Ying Lu" <bylu@gate.sinica.edu.tw>, Sinica

Title: The universality of the semi-classical sine-Gordon equation at the gradient catastrophe
Abstract: We study the semi-classical sine-Gordon equation with pure impulse initial data below the threshold of rotation:

$$\varepsilon^2 u_{tt} - \varepsilon^2 u_{xx} + sin(u) = 0,\ u(x, 0) \equiv 0,\ \varepsilon u_t(x, 0) = G(x) \leqq 0, \text{ and } |G(0)| < 2.$$

A dispersive-regularized shock forms in finite time. Using Riemann–Hilbert analysis, we rigorously studied the asymptotics near a certain gradient catastrophe. In accordance with a conjecture made by Dubrovin et. al., the asymptotics in this region is universally (insensitive to initial condition) described by the tritronquée solution to the PainlevéI equation. Furthermore, we are able to universally characterize the shapes of the spike-like local structures (rogue wave on periodic background) on top of the poles of the tritronquée solution. (Joint with Peter Miller)

Applied Math:

"P-王雲哲 Yun-Che Wang" <yunche@mail.ncku.edu.tw>, Civil Engineering, National Cheng Kung University

Title: On the extreme viscoelastic properties in composite materials due to fields governed by Allen-Cahn type PDEs
Abstract: In the framework of the Ginzburg-Landau phase transition theory, ferroelastic solid-solid phase transformations are phenomenologically modeled by the Allen-Cahn-type parabolic partial differential equations that govern the order-parameter fields. In the vicinity of the phase transition, the energy landscape of the system changes from a convex to non-convex profile, hence the interactions between the transforming domains and their surroundings give rise to extreme effective physical properties, such as unbounded viscoelastic modulus and damping. Effective negative stiffness arises in the domains with non-convex energy landscape. In this work, it is shown that our finite-element-based phase-field modeling numerical results are consistent with experimental findings. Effects of microstructure on the extreme properties are to be discussed. In addition, a machine-learning method to numerically solve the Allen-Cahn PDEs, along with viscoelasticity equations, will also be discussed. (Joint work with H.W. Lai and P.C. Cheng)
References
1. M.E. Gurtin, Generalized Ginzburg-Landau and Cahn-Hilliard equations based on a microforce balance, Physica D 92, 178-192 (1996)
2. Y.C. Wang, H.W. Lai, M.W. Shen, Effects of cracks on anomalous mechanical behavior and energy dissipation of negative-stiffness plates, Physica Status Solidi B, 1800489 (2018)
3. J. Han, A. Jentzen, W. E, Solving high-dimensional partial differential equations using deep learning, Proceedings of the National Academy of Sciences of the United States of America 115, 8505-8510 (2018)

"aP-周鼎贏 Dean Chou" <dean@ncu.edu.tw>, National Central University

Title: Utilising cerebroporomechanics to explore neurological conditions

Abstract: The world population is expected to increase to approximately 11 billion by 2100. The ageing population (aged 60 and over) is projected to exceed the number of children in 2047. This will be a situation without precedent. The number of citizens with disorders of old age like Dementia will rise to 115 million worldwide by 2050. The estimated cost of Dementia will also increase, from $604 billion in 2010 to $1,117 billion by 2030. At the same time, medical expertise, evidence-driven policymaking and commissioning of services are increasingly evolving the definitive architecture of comprehensive long-term care to account for these changes.

Technological advances, such as those provided by computational science and biomedical engineering, will allow for an expansion in our ability to model and simulate an almost limitless variety of complex problems that have long defied traditional methods of medical practice. Numerical methods and simulation offer the prospect of improved clinically relevant predictive information, and of course optimisation, enabling more efficient use of resources for designing treatment protocols, risk assessment and urgently needed management of a long-term care system for a wide spectrum of brain disorders. Within this paradigm, the importance of the relationship of senescence of cerebrospinal fluid transport to dementia in the elderly makes the cerebral environment notably worthy of investigation through numerical and computational modelling.

"aP-鄧君豪 Chun-Hao Teng" <tengch@nchu.edu.tw>, National Chung Hsing University

Title: High-order numerical methods for partial differential equations on a sphere

Abstract: In this talk, we will present computational approaches for solving partial differential equations on spherical surfaces, based on high-order numerical methods. We will use a model advection equation and the shallow water equations as examples to illustrate the computational framework, including domain decomposition of a spherical surface, governing equations in a general curvilinear coordinate, numerical schemes for simulations, and parallel computational efficiency.

Plenary Talks:

"aP-楊劼之 Ryosuke Takahashi" <tryotriple@gmail.com>, National Cheng Kung University

Title: Kapustin-Witten Equation, the Estimate for Yang-Mills Energy and First Pontryagin Number
Abstract: We will briefly introduce some background works on Kapustin-Witten equation and Nahm pole boundary condition. We will sketch the proof of Yang-Mills energy bound for the moduli space of Kapustin-Witten solutions on S^3 x R^+ with empty knot:

$$\int_M |F_A|^2 < C$$

for any (A; ϕ) ∈ $\mathfrak{M}$. We will also prove a formula for the first Pontryagin number for the moduli space of Kapustin-Witten solutions in the general case and propose a way to obtain its bound.

"PD-李信儀 Hsin-Yi Lee" <apostol2000@hotmail.com>, National Central University

Title: Global Shock Wave Solutions of Hyperbolic Balance Laws for Multi-lane Traffic Flow Model.
Abstract: In this talk, we consider a multi-lanes model of traffic flow, which is governed by a hyperbolic system of balance laws. The system of balance laws is given as a 2 by 2 nonlinear hyperbolic system with discontinuous source.
The global existence of entropy solutions to the Cauchy problem of this multi-lanes model is established by a new version of generalized Glimm method. The generalized solutions of the Riemann problem, which is the building block of the generalized Glimm scheme, are constructed by Lax's method and an invention of perturbations solving linearized hyperbolic equations with modified source terms. The residuals is estimated for the consistency of the generalized Glimm scheme. The wave interaction estimates are provided for the decay of Glimm functionals and the result for the asymptotic behavior of solutions.

"PD-王冠祥 Kuan-Hsiang Wang" <khwang0511@gmail.com>, National University of Kaohsiung

Title: On the Local Well-Posedness for the Quantum Zakharov System
Abstract: In this talk, we consider the local well-posedness for the quantum Zakharov system in spacial dimensions $d=1, 2, 3$. For 1D, the multilinear estimate is proved directly without Strichartz estimates. For 2D and 3D, the crucial nonlinear estimates are derived by the Strichartz estimates for fourth order Schrödinger equation and fourth order wave equation respectively . We obtain the regions of regularities of the quantum system for which the local well-posedness hold and cover the regions of local well-posedness for Zakharov system for $d=1, 2, 3$. We follow the work of Ginibre-Tsutsumi-Velo with some adaptions. Comparing with the result in their work, we improved the region of local well-posedness for Zakharov system in 1D.This is a joint work with Yung-fu Fang.

Direction to NCKU Campus 前往成功大學

HSR: Taiwan High Speed Rail 高鐵 NCKU: National Cheng Kung Univ. 成功大學

MRT: Metro Rapid Transit 高雄捷運 TRA: Taiwan Railway Administration 台鐵

MT: Metro Taipei 台北捷運 Taoyuan MRT: Taoyuan Metro Rapid Transit 桃園機場捷運

From Taipei Song Shan Airport (TSA) 松山機場：

Taipei Airport 松山機場 -- Take MT 台北捷運 brown line 5 minutes →

MT Zhongxiao Fuxing Station 忠孝復興站 -- Take MT 台北捷運 blue line 5 mins →

HSR Taipei Station 高鐵台北站 -- Take HSR 搭高鐵 110 minutes → Tainan Station 台南站

Take TRA (Shalun line) 搭台鐵沙崙線 22 minutes → TRA Tainan Station 台鐵台南站.

Exit the rear station 後站. Walk to the NCKU (10 minutes). 成功大學

From Taoyuan International Airport (TPE) 桃園機場：

Taoyuan Airport -- Taoyuan MRT 搭桃機捷運 15 minutes →HSR Taoyuan Station 高鐵桃園站

--Take HSR 搭高鐵 95 minutes →Tainan Station 高鐵台南站

-- Take TRA (Shalun line) 搭台鐵沙崙線 22 mins → TRA Tainan Station 台鐵台南站.

Exit rear station 後站. Walk to the NCKU (10 minutes). 成功大學

From Tainan International Airport (TNN) 台南機場：

Tainan Airport -- Taxi 20 minutes → NCKU. 成功大學

From Kaohsiung International Airport (KHH) 高雄小港機場：

Kaohsiung Airport -- Take Kaohsiung MRT 搭高雄捷運 20 minutes → TRA Kaohsiung Main Station 台鐵高雄站 --Take TRA train 搭台鐵 35 minutes → TRA Tainan Station 台鐵台南站.

Exit the rear station 後站. Walk to the NCKU (10 minutes). 成功大學

NCKU Campus and Hotels Map