2021 年生物数学与流行病控制国际研讨会

2021 International Symposium on Biomathematics and Control in Epidemics

（2021.5.20—5.21, online via Zoom）

Program

主办单位:

南京信息工程大学 (NUIST)

江苏省工业与应用数学学会 (JSIAM)

Content

Announcement

2021 International Symposium on Biomathematics and Control in Epidemics

The **Nanjing University of Information Science and Technology** (NUIST) is proud to announce that we will be hosting the **2021 International Symposium on Biomathematics and Control in Epidemics**. This symposium will provide an international forum for interdisciplinary experts to present their latest research findings, share innovative ideas, identify challenges and opportunities, and promote international collaborations in Biomathematics and Control in Epidemics. It will also provide an excellent opportunity for young researchers and students to interact with our leading scientists and learn hands-on research experience in these fields.

This international symposium is jointly hosted by **Nanjing University of Information Science and Technology**, and **Jiangsu Society for Industrial and Applied Mathematics (JSIAM)**. It is one of the important activities of the Science and Technology Activity Month of Nanjing University of Information Science and Technology, and will be held from May 20 – May 21 vitually online.

Register in advance (after registering, you will receive a confirmation email about joining): https://us02web.zoom.us/meeting/register/tZEqduuorzsjG9EZMEzPGAdNsCCjcYYpXrIL

▪ Invited Speakers (in order of the talks):

Pierre Auger, French Academy of Sciences, France; Nanjing University of Information Science and Technology, China

Huaiping Zhu, York University, Canada

Tri Nguyen-Huu, French National Institute of Research for Sustainable Development, France

Qi An (安琪), Nanjing University of Information Science and Technology, China

Ali Moussaoui, University of Tlemcen, Algeria

Daihai He (何岱海), Hong Kong Polytechnic University, Hong Kong, China

Yanni Xiao (肖燕妮), Xi'an Jiaotong University, China

Xuebing Zhang (张学兵), Nanjing University of Information Science and Technology, China

▪ Contact Information

School of Mathematics and Statistics, Nanjing University of Information Science and Technology, 219 Ningliu Road, Nanjing 210044, China

Wenjun Liu (刘文军), +86-0-139-1475-3220, wjliu@nuist.edu.cn

Xuebing Zhang (张学兵), +86-0-139-1296-5868, zxb1030@nuist.edu.cn

Qi An (安琪), +86-0-187-4574-6090, anqi@nuist.edu.cn

Kewang Chen (陈克旺), +86-0-198-5006-6546, kewangchen.cn@gmail.com

▪ Sponsors

Nanjing University of Information Science and Technology (NUIST), China

Jiangsu Society for Industrial and Applied Mathematics (JSIAM), China

Schedule

2021 年生物数学与流行病控制国际研讨会

2021 International Symposium on Biomathematics and Control in Epidemics

（2021.5.20—5.21, online via Zoom）

May 20th, 2021 **From 8:50 France / 14:50 China to 11:40 France / 17:40 China** **(https://us02web.zoom.us/meeting/register/tZEqduuorzsjG9EZMEzPGAdNsCCjcYYpXrIL)**				
14:50-15:00	Opening ceremony, Meeting Host: Wenjun Liu By Pierre Auger, Huaiping Zhu			
Invited Talks				
Time	Speaker	Institution	Title	Chair
15:00-15:40	Pierre Auger	French Academy of Sciences, France; Nanjing University of Information Science and Technology, China	On management strategies in order to stop an SEIR/SEAIR epidemic: Application to the SARS-CoV-2 epidemic	Tri Nguyen-Huu
15:40-16:20	Huaiping Zhu	York University, Canada	Modeling with delays for the transmission and control of COVID-19	
16:20-17:00	Tri Nguyen-Huu	French National Institute of Research for Sustainable Development, France	Long-term strategies against Covid-19	Pierre Auger
17:00-17:40	Qi An (安琪)	Nanjing University of Information Science and Technology, China	Pattern formation of a spatial memory model with nonlocal maturation delay and hostile boundary condition	

2021 年生物数学与流行病控制国际研讨会

2021 International Symposium on Biomathematics and Control in Epidemics

（2021.5.20—5.21, online via Zoom）

May 21th, 2021

From 9:00 France / 15:00 China to 11:40 France / 17:40 China

(https://us02web.zoom.us/meeting/register/tZEqduuorzsjG9EZMEzPGAdNsCCjcYYpXrIL)

Invited Talks

Time	Speaker	Institution	Title	Chair
15:00-15:40	Ali Moussaoui	University of Tlemcen, Algeria	Prediction of confinement effects on the number of Covid-19 outbreak in Algeria	Huaiping Zhu
15:40-16:20	Daihai He (何岱海)	Hong Kong Polytechnic University, China	Modeling of the COVID-19 outbreaks in Manaus, Brazil – effects of reinfection and new variant	
16:20-17:00	Yanni Xiao (肖燕妮)	Xi'an Jiaotong University, China	Modelling media impact on transmission dynamics of infectious diseases	Daihai He (何岱海)
17:00-17:40	Xuebing Zhang (张学兵)	Nanjing University of Information Science and Technology, China	Dynamics and patterns formation in homogeneous diffusive predator-prey systems with predator interference or foraging facilitation	

Abstract and Speakers' Introduction

On management strategies in order to stop an SEIR/SEAIR epidemic: Application to the SARS-CoV-2 epidemic.

Pierre Auger

IRD, UMI 209 UMMISCO, Bondy, France

Email: pierre.auger@ird.fr

We present classic SEIR model taking into account the daily movements of individuals in different places, the protection against the epidemic by the use of masks and partial confinement of individuals. We are studying the effects of combined confinement and protection measures on the dynamics of the epidemic. We consider a constant proportion of asymptomatic people. We show that the combination of the use of masks with almost complete release of confinement makes it possible to avoid the occurrence of a secondary peak of the epidemic. The model predicts that a total release of confinement can be successful for an epidemic of $R_0 = 2.5$ if on average a proportion of 60% of the population wears masks of 60% efficacy. In the next step, the confinement level is assumed to be infected dependent. Using a SEAIR model, depending on the choice of the infected dependent confinement function, we show that it is possible to generate an "Allee" effect that allows to extinguish the epidemic below some threshold. We discuss the opportunity to apply the method in the case of the SARS-CoV-2 epidemic.

Pierre Auger is a member of the French Academy of Sciences. His research field concerns the mathematical modeling of biological systems. He has developed an original approach to the integration of the organizational levels of these complex systems, which allows numerous applications, in agronomy or in medicine for example. In order to avoid the difficulties caused by a large number of variables and parameters in the process of model analysis, he presents a novel mathematical method to establish a simplified model according to the time scales of the processes occurring in different levels of biological system. They are mainly methods of aggregation of variables in dynamic systems. These methods were applied by Pierre Auger to the dynamics of populations and communities for the consideration of individual behaviors in population models and for the description of the spatial dynamics of a population in heterogeneous environments. In addition, he has also established mathematical models for the propagation of the depolarization wave in the ventricular wall of the heart and multiple problems in the thiofs fisheries. More recently, Pierre Auger has worked on modeling in epidemiology, more specifically on the effects of non-pharmaceutical protection and containment measures on the dynamics of the Covid-19 epidemic.

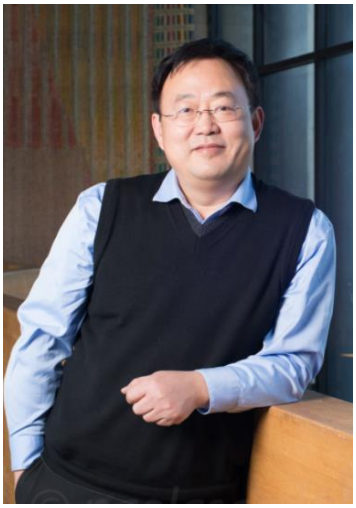
Modeling with delays for the transmission and control of COVID-19

Huaiping Zhu

Canadian Centre for Diseases Modeling (CCDM) and Lamps, York University, Canada

Email: huaiping@mathstat.yorku.ca

The ongoing COVID-19 epidemic poses a huge threat to global public health, waves of outbreaks continue to surge one year after it as declared as a global pandemic. There have been extensive modeling studies for the transmission which have been contributed greatly to inform decision-making. In this talk, I will discuss the roe of delays. It is well-known that dynamical models with delays generate complex asymptotic dynamics, asymptotical dynamics. Usually there are two types of delays: one is due to the development or evolution of the virus, like the incubation delay; the other is human but non-viral related, like delays in tracing and testing, quarantine and isolation, treatment due to lack of medical and health resources, or delays due to the impact of media, psychological and behavior. I will present models with the second type of delays in control or mitigate the epidemics of COVID-19. Examples of Wuhan and other cities worldwide will be used to explain the differences.



Huaiping Zhu, a professor of mathematics, York Research Chair (YRC Tier I) in Applied Mathematics. He is the director of the One Health Modelling Network for Emerging Infections (OMNI), Directors of the Canadian Centre of Diseases Modeling (CDM) the Laboratory of Mathematical Parallel Systems (LAMPS) at York University. His research interests include dynamical systems and Hilbert's 16th problem, bifurcation theory and applications; mathematical ecology and epidemiology; climate change modeling and impact studies. He develops mathematical models, theories, methodologies, and tools to inform and enhance public health for prevention and control of infectious diseases.

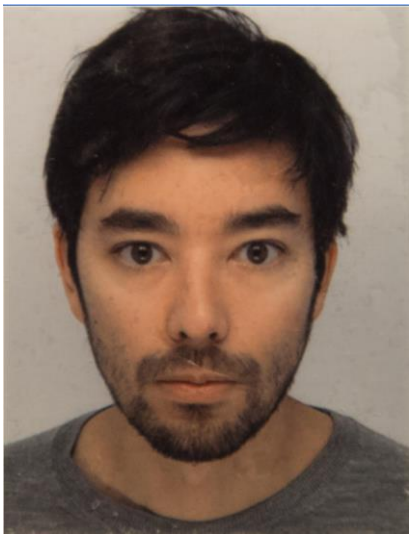
Long-term strategies against Covid-19

Tri Nguyen-Huu

French National Institute of Research for Sustainable Development

Email: tnguyenh@gmail.com

More than 16 month after the Covid-19 outbreak, many countries still struggle with the pandemic, with the shutting down of many activities and a loss of social life. Questions have risen about the management of the crisis, knowing that there is a contradiction between the objectives, like put an end to the epidemic and maintain an economical activity. We will present epidemiological models derived from SEIR models, to evaluate different strategies, their ability to extinguish or mitigate the epidemic, and the consequences in term of economical or social cost.



Tri Nguyen-Huu is a researcher at the French National Institute of Research for Sustainable Development. He develops mathematical and computer modelling methods, and more specifically on dynamical and complex systems, for several fields of application such as population dynamics, water resources exploitation, epidemiology or urban dynamics.

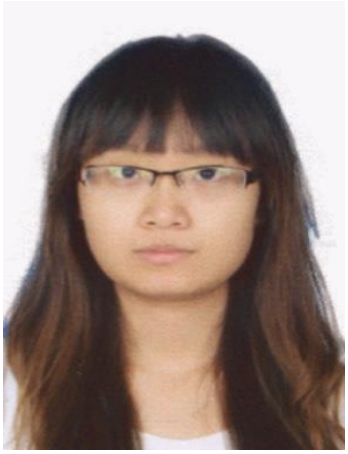
Pattern formation of a spatial memory model with nonlocal maturation delay and hostile boundary condition

Qi An

Nanjing University of Information Science and Technology, China

Email: anqi@nuist.edu.cn

In this talk, we propose and investigate a memory-based reaction-diffusion equation with nonlocal maturation delay and homogeneous Dirichlet boundary condition. We first study the existence of the spatially inhomogeneous steady state. By analyzing the associated characteristic equation, we obtain suffcient conditions for local stability and Hopf bifurcation of this inhomogeneous steady state, respectively. For the Hopf bifurcation analysis, a geometric method and prior estimation techniques are combined to find all bifurcation values because the characteristic equation includes a non-self-adjoint operator and two time delays. In addition, we provide an explicit formula to determine the crossing direction of the purely imaginary eigenvalues. The bifurcation analysis reveals that the diffusion with memory effect could induce spatiotemporal patterns which were never possessed by an equation withoutmemory-based diffusion. Furthermore, these patterns are different from the ones of a spatial memory equation with Neumann boundary condition. This is a joint work with Chuncheng Wang and Hao Wang.



Qi An, an Assistant Professor of the School of Mathematics and Statistics, Nanjing University of Information Science and Technology. She received her doctorate from Harbin Institute of technology in 2019 and was selected into the innovation and entrepreneurship talent introduction plan of Jiangsu Province in 2020. Her main research interests are bifurcation theory and stability of the partial functional differential equation. She has published 6 papers in academic journals such as Journal of Differential Equation, Discrete and Continuous Dynamical Systems. Recently, she is working on the dynamics of population models with spatial memory effects. She received funding from the Natural Science Foundation of Jiangsu Province and the Natural Science Foundation of Jiangsu Higher Education Institutions.

Prediction of confinement effects on the number of Covid-19 outbreak in Algeria

Ali Moussaoui

University of Tlemcen, Algeria

Email: moussaouidz@yahoo.fr

The first case of coronavirus disease 2019 (COVID-19) in Algeria was reported on 25 February 2020. Since then, it has progressed rapidly and the number of cases grow exponentially each day In this talk, we present SEIR model to forecast COVID-19 outbreak in Algeria under two scenarios by using the real-time data from March 01 to April 10, 2020. In the first scenario: no control measures are put into place, we estimate that the basic reproduction number for the epidemic in Algeria is 2,1, the number of new cases in Algeria will peak from around late May to early June and up to 82% of the Algerian population will likely contract the coronavirus. In the second scenario, at a certain date T, drastic control measures are taken, people are being advised to self-isolate or to quarantine and will be able to leave their homes only if necessary. We prove that the final size of the epidemic depends strongly on the cumulative number of cases at the date when we implement intervention and on the fraction of the population in confinement. Our analysis shows that the longer we wait, the worse the situation will be and this very quickly produces. This is a joint work with Pierre Auger.

Ali Moussaoui is the professor and director of the Laboratory of Nonlinear Analysis and Applied Mathematics at Tlemken University in Algeria. He received his doctorate from Tlemcen University in 2008, and obtained the Habilitation à Diriger les Recherches' (HDR) from Tlemcen University and Le Havre University in 2010 and 2017, respectively. In 2015, he was qualified as "Professor at French universities" in session 26, by the CNU in Paris and became a professor of the Department of Mathematics in University of Tlemcen. In 2020, he was awarded the Maurice Audin Prize. Professor Ali Moussaoui has published more than 40 academic papers. His research area concerns the mathematical modeling of biological systems. He is particularly devoted to mathematical models and methods in population dynamics and fishery resources. Recently, Ali Moussaoui has been working on modeling in epidemiology, more specifically on the effects of non-pharmaceutical protection and containment measures on the dynamics of Covid-19 epidemic.

Modeling of the COVID-19 outbreaks in Manaus, Brazil – effects of reinfection and new variant

Daihai He

Hong Kong Polytechnic University, Hong Kong, China

Email: daihai.he@polyu.edu.hk

Manaus, Amazonas, Brazil, with a population of 2.2 million, has experienced two waves of the COVID-19 outbreaks in one year, with more than 10,000 deaths as of February 2021. In a work published in Science, it was reported that the first wave infected more than three-quarters of the population, based on serological data from routine blood donors. However, the arrival of the second wave means the failure of the herd immunity theory (with 3/4 of the population being infected in the first wave, the second wave should be prevented). At the same time, a new variant of the virus was discovered in the second wave and sporadic re-infection cases were found. Therefore, it has attracted wide media attention. Our team re-analyzed the blood donor data, together with the COVID-19 death data and applied state-of-the-art model technique, and concluded that the first wave of the epidemic only infected about 30% of the population, and re-infection was not the main factor in causing the second wave. We considered a simple model with no age structure, a model with an age structure, and a competing model of two viruses.

Daihai He, an Associate Professor of the Department of Applied Mathematics, Hong Kong Polytechnic University. He earned a Ph.D. in Engineering from Xi'an Jiaotong University in 1999 and a Ph.D. in Mathematics from McMaster University in Canada in 2006. He also did post-doctoral research in Beijing Normal University (China), University of Michigan (USA), and Tel Aviv University (Israel). His main research interests are infectious disease modeling and statistical analysis of medical data. More than 90 papers have been published in journals such as Science Advances, Annal of Internal Medicine, European Respiratory Journal, Journal of the Royal Society Interface, and the research results have been widely reported in media. His modeling of yellow fever in Angola Africa won the second place in the 2018 International Society for Disease Surveillance's Best Scientific Contribution Paper; He has four highly cited papers on the study of COVID-19, one highly cited paper on Zika virus disease study and one highly cited paper on plug-and-play disease modelling framework. He received funding from the Hong Kong Research Grants Council project, the Health and Medical Research Fund Hong Kong, and the Alibaba (China) Co. Ltd. Cooperative Research Fund.

Modelling media impact on transmission dynamics of infectious diseases

Yanni Xiao

Xi'an Jiaotong University, China

Email: yxiao@mail.xjtu.edu.cn

There are many challenges to quantifying and evaluating the media impact on the control of emerging infectious diseases like A/H1N1, COVID-19 and etc. In this study, we proposed a delay differential model, associated with the response time for individuals to the current infection, to examine the media impact on the transmission dynamics of infectious diseases. We investigated the global bifurcation by considering the delay as a bifurcation parameter and examined the onset and termination of Hopf bifurcations from a positive equilibrium. We then parameterized the proposed model on the basis of the 2009 A/H1N1pandemic influenza data in Shaanxi province, China, and estimated the basic reproduction number and the time delay. Further, we apply this methodology to investigate the media impact on COVID-19 infection by combining with data on confirmed cases and news items. We then obtained the estimation of the basic reproduction number. Sensitivity analysis showed that enhancing the response rate of the public awareness to the media reports can bring forward the peak time and reduce the peak size of the infection significantly. These findings suggested that media coverage can be considered as an effective way to mitigate the disease spreading during the initial stage of an outbreak.

Dr. Yanni Xiao, professor of Xi'an Jiaotong University, Xi'an, China, director of the Interdisciplinary Research Center of Mathematics and Life Sciences (IRCMLS). She obtained her PhD from Academy of Mathematics and Systems Science (AMSS), Chinese Academy of Sciences (CAS) in 2001, and then she did postdoc in AMSS and the University of Liverpool, Uk. Dr. Xiao has colloborated with China CDC on modeling HIV/AIDS infection as a PI of modelling subproject of National Mega-project of Science Research, with Chinese PLA Institute for Disease Control and Prevention on modelling hospital infection. She has served as PI for several NSFC grants and published papers in the subjects of non-smooth dynamical system and mathematical epidemiology in journals of J Differ Equations, P Roy Soc B-Biol Sci, BMC Medicine, J Math Biol, Bull Math Biol and etc.

Dynamics and pattern formation in homogeneous diffusive predator-prey systems with predator interference or foraging facilitation

Xuebing Zhang

Nanjing University of Information Science and Technology, China

Email: zxb1030@nuist.edu.cn

In this take, we study a general diffusive predator-prey system under Neumann boundary conditions. First, we examine the global attractor and persistence of the system, which characterize the long time behavior of the time-dependent solution, and the stability of all non-negative equilibria of the system. Then by analyzing the associated characteristic equation, we derive explicit conditions for the existence of Hopf bifurcation and Turing instability. Furthermore, the existence and non-existence of nonconstant positive steady states of this model are studied through considering the effect of large diffusivity. Finally, in order to verify our theoretical results, some numerical simulations are also included. The results show that under the effect of diffusion, system shows different spatial patterns which can be stationary, periodic and chaotic.

Xuebing Zhang, an Associate Professor of the School of Mathematics and Statistics, Nanjing University of Information Science and Technology. He received his doctorate from Nanjing University of Information Science and Technology in 2017. His main research interests are dynamic analysis of reaction diffusion biological population model. He has published more than 20 papers in academic journals such as Journal of Theoretical Biology, Mathematical Biosciences, Computers & Mathematics with Applications, Nonlinear Analysis: Real World Applications, Applied Mathematics Letters. He received funding from the Natural Science Foundation of Jiangsu Province.

A Brief Introduction to the

School of Mathematics and Statistics, Nanjing University of Information Science and Technology (NUIST), China

About NUIST

NUIST, formerly named **Nanjing Institute of Meteorology**, was established in 1960 and enjoys the reputation as "the cradle of meteorological talents in China".

In 1978: Listed as one of the 88 National Key Universities in China.

In 2004: Renamed as **Nanjing University of Information Science & Technology**.

In 2017: Selected as National "Double-First-Class" Construction University.

Rankings: #41 in Best Global Universities in China / #511 in Best Global Universities (U.S. News);

#50-71 in Mainland China / #401-500 in World-University-Rankings-2020 (ARWU).

A^+: Meteorology was ranked Top 1 in subject assessment by the MOE and rated A^+ in China.

About School of Mathematics and Statistics

The School of Mathematics and Statistics (SMS) in NUIST, is eligible to offer Master's and PhD programs in **Mathematics**, Professional Master's program in **Applied Statistics**, as well as postdoctoral positions of Mathematics. **Mathematics** is the key discipline of China Meteorological Administration.

The School also offers three undergraduate majors including Information and Computing Science, Applied Statistics, and Mathematics and Applied Mathematics, which are all key majors of Jiangsu Province, China. Information and Computing Science was selected as the **First-class** undergraduate major by the MOE.

Rankings: #30 in Mathematics **in China** / #166 in Mathematics (U.S. News);

49-75 in Mathematics **in mainland China** / #301-400 in Mathematics (ARWU).

Faculty: The School has personnel of highly qualified teachers with strong research capabilities. The School currently has over 110 faculty members, including 32 professors and 21 PhD supervisors, 41 associate professors / associate researchers.

Honor & Awards:

- Norbert Gerbier-Mumm International Award, World Meteorological Organization (2001)

- National Thousand Talents Program, Fok Ying-Tong Education Foundation, Distinguished Professor of Jiangsu Province, etc.
- Outstanding award in COMAP's Mathematical Contest in Modeling (MCM) / Interdisciplinary Contest in Modeling (ICM) (2012, 2018, 2019)
- The only prize of the highest rank, namely the Higher Education Press Cup, in the National Mathematical Modeling Contest for undergraduates (2011)

- The first class award for National teaching achievement by the MOE (2014)
- The first class award for teaching achievement of Jiangsu Province (2011, 2017)
- Many awards as national brand curriculum, excellent curriculum of Jiangsu Province, key textbook of Jiangsu Province, excellent textbook of China Meteorological Administration

Research in School of Mathematics and Statistics

Research Areas and Features:

- We focus on the problem-driven theoretical research, and a strong research team has been formed in the fields of fluid dynamics, scientific calculation, statistical inference, time series, algebra and number theory, etc.
- We emphasize on the intersection and integration with the atmospheric sciences, develop mathematical technology to solve key problems in interdisciplinary research, and carry out extensive and in-depth research on the application of multiple linear models to typhoon

diagnosis, the application of control theory to data assimilation, earth system model and other atmospheric mathematics, etc.

Platform: The National center for applied mathematics (jointly), the National virtual simulation experimental teaching demonstration center, the big data key laboratory of Jiangsu Province, 4 enterprise cooperative education platforms of MOE, and 5 enterprise postgraduate workstations of Jiangsu Province, which can provide excellent social resource for enhancing the students' innovation and enterprise ability.

International and Industrial Collaboration: On average, about 30 mathematicians or business experts from around the world visit the School each year for 2 to 4 weeks, conducting joint research with local mathematicians and statisticians, holding seminars, and making themselves available for consultation with students working in their area. Through teaching partnership and active cooperative research projects, the School has close ties with the industry such as Huawei and Neusoft.

Fund: In the past five years, the academic team of the School has received 55 National projects and 76 other level projects, including 973 Program, National Key Research and Development Program of China, Key Program of NSFC and so on, altogether 39.8 million (CNY).

Publications: More than 400 papers in SCI journals like **Trans. Amer. Math. Soc.**, **Adv. Math.**, **J. Funct. Anal.**, **Sci. China Math.**, **Arch. Ration. Mech. Anal.**, **SIAM** journals, **IEEE** journals, etc, and more than 30 monographs and textbooks, in the past five years.

Education in School of Mathematics and Statistics

Aims: Advancing mathematical and statistical knowledge through novel and insightful research. Training experts in not only mathematics but also other academic, industrial, and applied fields.

International Joint Training Program: International cooperation with **University of Reading**, **Florida State University, Carleton University**, etc., carrying out joint enrollment and training of undergraduate, master and PhD students, as well as regular academic exchanges.

Employment and Further Education: High quality employment rate is over 98.2%, including research, teaching and technology development in the field of government agencies, research institution, education, IT, meteorology, finances and so on. The rate of studying abroad as a postgraduate is over 30%, and many graduates have been enrolled in domestic and foreign famous universities such as **Cornell University**, **University of Edinburgh**, **Columbia University**, **Imperial College London**, **Tsinghua University**, **Chinese Academy of Sciences**, etc.

Future of Our Students: The School cultivates a number of prominent alumni including "1,000 Talents Plan" and tenured professors in USA and European countries, and makes important contributions in the field of numerical prediction, climatic statistics, data assimilation and the application of differential equation, etc.

Website: https://math.nuist.edu.cn/3305/list.htm Email address: sms@nuist.edu.cn

南京信息工程大学 1960 NANJING UNIVERSITY OF INFORMATION SCIENCE & TECHNOLOGY

祝您生活愉快！

Wish you a happy life.