

# 戴 万 阳

南京大学数学系教授(博导/重要学科岗)、江苏金融科技研究中心特邀专家, 国家自然科学基金奖励委员会数学学科会评委员(随机分析组长)、国家自然科学基金重大/重点(包括杰出青年/优秀青年)项目评审专家, 国际应用数学进展杂志(Journal of Advances in Applied Mathematics)与国际信息工程杂志(International Journal of Informational Engineering)主编; 曾任美国电信(现称诺基亚)贝尔实验室(AT&T (now called Nokia) Bell Labs)永久(Permanent)科学家与研究员、重大/重点项目首席科学家与研究员(Principal Investigator)、并获美国乔治亚理工大学(Georgia Institute of Technology)的博士学位; 现任国家与江苏省多个概率、统计及运筹管理学会常务理事与副理事长。

戴万阳在随机网络的反射扩散逼近、随机(渐近)最优控制与(随机微分)博弈论及(正倒向与斜反射)随机(常/偏)微分方程等领域作了多项重要系列工作, 其成果受到了众多美国科学院院士与美国工程院院士、INFORMS Lanchester 奖得主及 John von Neumann 奖得主等著名科学家的引用、沿用与发展, 是 1998 年世界数学家大会概率统计领域 45 分钟特邀报告有关理论与方法的原创者, 众多有影响的成果发表在国际顶尖、权威与著名杂志(包括 Operations Research, Journal of Computational and Applied Mathematics, Queueing Systems, Mathematical and Computer Modeling of Dynamical Systems)上, 多次在国际国内学术会议上做特邀大会主旨报告, 是 2002 年第 7 届中国概率统计年会的特邀报告者、2016 年第 10 届中国运筹学年会的特邀专题报告者, 其(1996-1998)发明的有关支撑各种决策与大数据解析的网络与计算机云平台操作系统及数据库并实现网络平台、智能引擎与终端用户分离以全方位达到即插即用 (Plug-in and Play) 目的的成果与产品获得了美国贝尔实验室的(1998 年)内部技术转让(Technology Transfer)。

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## (Wanyang Dai's CV in Chinese)

### 学历

- **博士 (1992 – 1996):** 美国 Georgia Institute of Technology (由数学学院和工业与系统工程学院共同培养), 博士论文研究方向: 随机网络的布朗与扩散过程逼近理论、分析、数值求解方法和计算机实现及其在现代信息系统(通讯网络等)中的应用
- **硕士 (1985 --1988):** 上海大学数学系。硕士论文研究方向: 随机自适应控制与跟踪问题及最优控制与鞅
- **学士 (1981 – 1985):** 南京师范大学数学系。学士论文研究方向: 一些泛函算子的性质

### 工作经历

- **教授、博导/3级重要学科岗 (2015-- ):** 南京大学数学系 (正常情况下, 一个教授(+博导)需至少任职 12 年并做出卓越科学成就才有可能获得这样一个重要岗的奖励)
- **教授(博导) (2004--2015):** 南京大学数学系
- **访问教授 (2007.3—2007.5):** 香港中文大学系统工程与工程管理系
- **研究学者 (2004.1--2004.3):** 美国数学及其应用研究所(IMA), 是 IMA2004 年年度项目复杂系统(金融工程、通讯网络、基因学等)中的概率统计的长期参与者。IMA 是由美国自然科学基金创办并挂靠在美国明尼苏达大学的国家开放实验室
- **访问学者 (2001.7--2001.9):** 中国科学院数学与系统科学研究院
- **副教授 (1999–2004):** 南京大学数学系
- **MTS (Permanent Position, 该机构内科学家和研究员等的总称与工资等级, 1996-1999):** 美国电信(现称诺基亚)贝尔实验室(AT&T (now called Nokia) Bell Labs), 是一些重点和大型项目的主要研究开发成员(Principal Investigator 或称首席科学家和研究员)或参与者(SimNet, Lucent Network Vision, Lucent ATM/IP Network Performance, Listening Post, etc.)
  - **注:** 贝尔实验室(Bell Labs)曾产生 14 位诺贝尔奖、 4 位图灵奖等众多国际重大奖项的获得者, 是中国中央及国家人才工作会议上点名要重点招聘的三个著名研究机构及大学(麻省理工学院、斯坦福大学、贝尔实验室)之一, 故不应当仅将之“解释”或“理解”为一普通“实验室”
- **讲师与助教 (1988-1992):** 南京大学数学系概率统计专业。所从事的研究领域包括随机自适应最优控制、系统识别与参数估计、时间序列分析与随机过程 (尤其是与鞅相关的收敛性分析); 是国家自然科学基金资助项目“随机稳定与控制”的主要研究人员与项目随机控制研究计划部分的设计与创作者

## 社会(学术)兼职

- 国家自然科学基金奖励委员会(现任或曾任)数学学科会评委员、会评随机分析组组长与国家自然科学奖评审专家
- 国家自然科学基金重大/重点(包括杰出青年/优秀青年)项目评审专家
- 中国概率统计学会理事
- 中国工程概率统计学会常务理事
- 中国运筹学会随机服务与运作管理分会(原中国排队论学会)常务理事
- 中国运筹学会智能工业数据解析与优化专业委员会常务理事
- IIGSS-CB 概率统计学会常务理事并兼学术委员会委员
- 江苏概率统计学会副理事长
- 江苏现场统计学会副理事长并兼信息技术专业委员会主任
- 江苏工业与应用数学学会常务理事并兼学术委员会委员

## 主要学术成就

- 首次创立了通过证明振荡不等式、不变原理、鞅收敛定理、饱和传输定理的弱收敛方法证明了具有有限缓容量的队长过程可由一类反射扩散过程(半鞅反射布朗运动)来逼近的泛函极限定理,该证明方法克服了由于相应的有关 Skorohod 问题解的不唯一性而导致已有证明方法不可用的困难,为该领域提供了全新的证明方法。我们首次在 1995 年 INFORMS 应用概率年会上已对此方法作了邀请报告并分发了正式的 Preprint 给诸多与会者且于 1996 年发表了正式的博士论文。之后,在数学界中最具权威最有影响的世界数学家大会(1998 年)上特邀了 Williams 作了概率统计方面的 45 分钟报告,介绍了利用此法与另一 45 分钟特邀报告者的有关结论解决了有关多类排队网络的随机扩散逼近问题,由于 Williams 所解决问题的核心难点也是有关 Skorohod 问题解的不唯一性,因而在她相应突破性的成果中指出了她的成果与我们的成果是同时期相互独立做出的。
- 首次利用有限元方法设计了有关的算法用来计算高维(3 维以上)半鞅反射布朗运动的平稳分布及其在排队网络中的应用,其核心思想是借助于有限元与 Galerkin 方法求解高维偏微分方程的弱解,该成果受到了诸多领域的诸多著名学者的推广与引用。
- SimNet (1996-1998): 主要研究与开发成员(Principal Investigator 或称首席科学家和研究员)并协助技术管理。该项目是由美国贝尔实验室(Bell Labs)数百万美元研发基金资助并由多个部门(包括网络结构、网络设计、网络性能、数学中心和计算机软件等部门)参与的重点研发项目,由贝尔实验室总裁(president)命名,该项目的目标是研发出新一代通讯网络的设计、性能评估与定价的有效模型、算法与分析引擎,并开发出相应的数据库与操作演示系统来支撑各种决策与大数据解析,其核心思想与技术之一就是开创性地提出与发展当今所谓的云计算技术并实现网络与计算机云平台、智能引擎及终端用户分离以全方位地达到即插即用(Plug-in and Play)的目的,所得研发成果与产品获得了当时朗讯公司与贝尔实验室的内部技术转让(Technology Transfer)。
- 针对有线与无线通信界近 20 年来广受关注的系统数据包输入信号过程具有

长相依这一现象展开研究。通过对计算机的硬件以及模拟计算所使用的软件进行深刻的分析,我们发现计算机中处理的有关随机变量都是所谓的截尾随机变量。因而我们可以断言:通信界中的一些著名计算机与统计实验所得到的长相依现象与实际有差距。究其原因是因为这些实验使用了计算机上无法实现的具有方差无穷或均值无穷的重尾随机变量,而截尾的随机变量只能是轻尾的。据此发现再加上我们以前发展的有关反射高斯过程的逼近理论(包括短期相依或长相依逼近两方面的理论),我们可以证明由一批贝尔实验室科学家所作的大型计算机与统计实验结果应趋于与实际相符而与他们的长相依假设相背,这就使得该领域里一个长期存有争议的现象有了比较圆满的解释。

- 基于无线通信系统按有限状态连续时间马氏过程演化衰减的特征,我们建立了一个处于随机环境中的处理器共享的多类别用户的广义并行队列系统,并为该系统设计出了基于约束非线性优化与 Nash 均衡问题解的实时动态资源配置策略。在引进能够处理随机环境的非常规饱和和传输条件下,我们证明了该实时动态资源配置策略具有渐近最优性,比如:在该策略下,系统的总的负荷与有关的成本函数可以达到渐近最优,而相应的估计该系统性能模型可以由一类具有机制转换的反射随机微分方程来刻画,它是反射布朗运动的更一般形式。为了将上述所设计的资源配置策略(算法)与相应的理论成果应用到多用户多进多出上行与下行(MIMO MAC 和 MIMO BC)的无线信道中,我们证明了在任一随机环境状态下,多用户 MIMO MAC 或 MIMO BC 的容量区域是由一定数目的线性或光滑曲面组成的凸区域,这便进一步解决了信息论领域中一个广受关注的容量域刻画问题,从而为我们成功地将上述算法与理论应用到这些无线通信系统中而打下了基础,并且这些成果已得到国内外同行的关注与引用。
- 由于云计算与大数据的应用日益突显其重要性,我们基于有关无线云计算系统的构想,设计了基于云平台的下一代通信网络的结构,并在马氏随机网的前提下,为网络节点由并行服务器组成的云通信网络进行了性能评估的数学建模,在抢占型优先权的控制策略情况下,为相应的排队网络导出了有关迭代算法并在数学上证明了该迭代的正确性,同时也用随机反射扩散模型进行了数值比较以证明其实际的有效性,从而为进一步地研究该类网络的性能评估提供了有效的比较准则。
- 提出了一类新的归一化的具有跳跃的高阶偶合正倒向随机偏微分方程并在一定条件下得到其适应强解的存在性与唯一性。同时,我们也提出了一类新的归一化的具有跳跃及斜反射的偶合正倒向随机常微分方程并在一定条件下得到其适应弱解的存在性与唯一性。此外,我们也设计出了有关数值方法去求解上述方程并研究了有关基于随机场的 Malliavin Calculus 的理论及性质从而得到了有关基于 Malliavin Derivative 的倒向随机偏微分方程适应解的存在与唯一性问题,进而利用这些 Malliavin Calculus 的理论与方法去解决我们所设计的数值方法的收敛性与收敛速度。
- 利用随机扩散逼近、随机最优控制与随机分析等方法解决了通信网络系统和金融数学等领域一系列的最优决策控制与博弈问题。
- 针对无线通信系统中资源动态配置同时受到信号过程的随机不确定与系统自身随机不确定的双重影响,我们提炼出了一类源自于金融数学的随机环境下的随机微分最优控制与资源配置系统,这类系统不仅在金融工程中有着重要的意义,而且对无线通信系统的控制与资源配置也有着很好的前瞻意义。

具体的研究内容可概括为如下几个方面：第一，我们设计了一类由非高斯 Levy 过程驱使的随机微分方程作为外部环境风险因子而由广义高维 Black-Scholes 模型刻画价格演化的非完全金融市场，从而为杠杆作用带来的跳水及批处理带来的巨烈波动现象的描述奠定了一定的基础。第二，基于上述系统，我们考虑了一般性的随机未定权益并设计了最优动态配置与投资组合策略使得逼近未定权益的风险在均方意义下达到最小。第三，我们发展了有关的数学理论与方法严格地证明了上述所设计策略的最优性，这些理论与方法包括证明非完全金融市场中方差最优等价鞅测度的存在性及构造其显式表达式等，同时也证明了带 Levy 跳跃非常规倒向随机微分方程解的存在唯一性等。这种以鞅方法为基础的处理手段与我们发表的以最优反馈控制为基础的处理手法构成一个整体，从不同侧面解决了金融数学与工程中的有关重要热点问题，也为进一步在无线通信系统中的应用打下坚实的基础。

- 考虑了与多类别用户多输入多输出正交频分多址系统相对应的多类别用户零缓存的并行随机服务系统，利用约束最优控制的方法将有关的随机最优控制的问题转化为一确定性最优控制问题来考虑，得其解以后再来设计原问题的最优控制策略问题。利用该方法所得的模型与利用流体逼近所得的最优控制模型相近，但它却能处理预热过程中所出现的非平稳问题。而相对于理论与实际中常用的马尔可夫决策过程，我们的方法在某些参数域中是比马氏决策过程要优越的。
- 指导并与我的博士后合作，在基于分数 Levy 过程的随机积分及由分数 Levy 噪声驱使的随机(常与偏)微分方程领域做了一系列的工作，在有关方程的系统构成、解的唯一存在性与解的构造方面做了一些开创性的研究，并且部分发表的成果已得到国内外同行的关注与引用。

## 研究成果的影响

- 戴万阳的论文(有的当时还是预印本(preprint))得到了国际同行论文的多次沿用、发展和应用，其中包括 1 位美国科学院院士的论文、2 位美国工程院院士的论文、1 位美国科学与艺术院院士的论文、INFORMS Lanchester 奖得主的论文、3 位 INFORMS John von Neumann 奖得主的论文、数学界中最有权威最有影响的世界数学家大会概率统计方面 45 分钟特邀报告者的会议论文(1998 年)和该报告者的其它 4 篇次突破性及重要论文(该报告者也是美国科学院院士，美国数学学会(AMS) Fellow, INFORMS Fellow 与 INFORMS John von Neumann 奖及应用概率最佳论文得主)、另一 IEEE Fellow 与 INFORMS 应用概率最佳论文得主的有关复杂网络控制技术的专著《Control Techniques for Complex Networks》、《Queueing Systems》杂志前主编的论文、《Operations Research》杂志随机模型 2 位区域主编(Area Editor)的 4 篇重要论文、国际数理统计学会(IMS)前任理事长(Prsident)的论文与 INFORMS 应用概率学会 3 位前理事长(Chair)的重要论文等等。另外，戴万阳是一些大型或重点现代通信网络项目的主要研究与开发成员，有一个研发项目的研究成果获得了美国朗讯公司与贝尔实验室(Bell Labs)的内部技术转让(Technology Transfer)，曾多次在国际国内学术会议上作特邀大会主旨报告和其它邀请报告并获得国际一般系统论研究会(IIGSS)首届中国概率统计年会优秀论文一等奖(2008)

- 应邀担任国际期刊杂志《International Journal of Information Engineering》与《Journal of Advances in Applied Mathematics》的主编(Editors-in-Chief), 并应邀担任众多有关数学、应用数学与物理学、概率统计、计算机和信息科学与技术及工程、无线和有线通信技术与工程、运筹学与最优化、系统科学与系统工程、最优控制、金融学与管理科学等国际期刊杂志的主审(Editor)与编委, 同时也多次应邀担任相关国际学术会议的大会主席(General Chair)与程序委员会委员
- 引用戴万阳论文的著名杂志包括: Annals of Applied Probability, Advances in Applied Probability, Queueing Systems, Stochastic Processes and Their Applications, Probability in the Engineering and Informational Sciences, Operations Research, Mathematics of Operations Research, Applied Mathematics and Mechanics, Journal of Computational and Applied Mathematics, Mathematical Methods of Operations Research, Computing, Proceedings of the International Congress of Mathematicians, IEEE Transactions on Mobile Computing 等等
- 引用戴万阳论文的著名机构包括: 美国斯坦福大学、加州大学、贝尔实验室等等

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### ● 国际英文杂志

- 总编(Editors-in-Chief)
  - ◇ International Journal of Information Engineering (2013--)
  - ◇ Journal of Advances in Applied Mathematics (2015--)
- 客座主编(Guest Editor)
  - ◇ Special Issue on Mathematical Problems in Engineering, (Journal of Engineering (2014)
- 编审(Editors)
  - ◇ Wireless Engineering and Technology (2010--)
  - ◇ Journal of Man, Machine and Technology (2012--)
  - ◇ Open Journal of Optimization (2012--)
  - ◇ Science Road Journal (2013--)
  - ◇ Journal of Applied Mathematics and Physics (2013--)
  - ◇ German Journal of Advanced Mathematical Sciences (2014--)
- 合作编审(Co-Editor)
  - ◇ Journal of Fundamental and Applied Sciences (2103--)
- 曾任编审(Past-Editors)
  - ◇ Greener Journal of Computer Science (2011-2013)
  - ◇ Journal of Internet, Information and Communication Systems (2011-2013)
- 编委(Member of Editorial Board since 2013)
  - ◇ International Journal of Wireless Networks and Communication
  - ◇ World Journal of Wireless Networks and Applications

- ◇ Journal of Wireless and Mobile Communication Engineering
- ◇ International Journal of Computational & Neural Engineering
- ◇ International Journal of Operations Research
- ◇ Open Journal of Information Technology & Operations Management
- ◇ Global Journal of Operations Management and Services
- ◇ International Journal of Game Theory
- ◇ Journal of Control Science and Engineering
- ◇ International Journal of Mechanic Systems Engineering
- ◇ International Journal of Information Science
- ◇ Research Open Journal of Information Science and Application
- ◇ International Journal of Telecommunication Engineering
- ◇ International Journal of Computer Science and Application
- ◇ American Journal of Computer Technology and Application
- ◇ International Journal of Networking & Computer Engineering Research
- ◇ International Journal of Circuits and Systems
- ◇ Modeling and Simulation
- ◇ World Journal of Mathematical Modeling and Applied Computing
- ◇ American Open Statistics & Probability Journal
- ◇ International Journal of Statistics and Mathematics
- ◇ International Open Journal of Statistics Research
- ◇ Open Research Journal of Statistical Design and Analysis
- ◇ International Open Journal of Finance
- ◇ Research Open Journal of Finance and Management
- ◇ World Open Journal of Finance and Economics
- ◇ International Journal of Mathematical Finance
- ◇ International Open Journal of Mathematics
- ◇ International Journal of Advanced Mathematics
- ◇ International Journal of Advanced Mathematics and Physics
- ◇ International Open Journal of Mathematics and Physical Science
- ◇ International Journal of Advanced Calculus

## ● 国际英-中文杂志

- 编委(2012--2013), Application of Information and Communication Technology
- 编委(2013--2013), Scientific Journal of Mechanic Engineering

## ● 国际中文杂志

- 编审(Editor) (2012--), Journal of Statistics and Applications

## 国际学术会议兼职

- 大会主席, 2018 Spring World Congress of Engineering and Technology
- 大会主席, 2017 Spring World Congress of Engineering and Technology
- 大会(荣誉)主席, International Conference on Intelligent Cloud Computing (ICC 2016)

- 大会主席, 2016 Spring World Congress of Engineering and Technology
- 大会主席, 2016 3rd International Conference on Computer Science and Application
- 大会主席, 2015 Spring World Congress of Engineering and Technology
- 大会主席, 2014 Spring World Congress of Engineering and Technology
- 大会主席, 2013 Spring World Congress of Engineering and Technology
- 程序委员会主席, 2013 International Conference on Recent Advances in Physics
- (邀请)特别分组组织者, SPDEs/SDEs and Stochastic Systems with Control/Optimization and Applications under The 11th AIMS Conference on Dynamical Systems, Differential Equations and Applications, Orlando, Florida, USA, July 1-5, 2016
- (邀请)分会组织者, SPDEs/SDEs, Queues, and Optimization with Applications under 8th International Congress on Industrial and Applied Mathematics (ICIAM), 2015
- 特邀嘉宾论坛主席: Queues and Operations Management under The 8th International Annual Conference of Chinese Scholars Association for Management Science and Engineering (CSAMSE), Shenyang, China, July 25-27, 2015,
- (邀请)特别分组组织者, Theory, Numerical Methods, and Applications of Stochastic Systems and SDEs/SPDEs under The 10th AIMS (American Institute of Mathematical Sciences) conference on Dynamical Systems, Differential Equations and Applications, Madrid, Spain, 2014
- (2014 世界数学家大会邀请)分组主席, Mathematics in Science and Technology (SC17-05) under International Congress of Mathematicians (ICM) 2014, Coex, Seoul, Korea, August 13-21, 2014
- 组织委员会委员
  - [10th World Congress on Healthcare & Technologies](#), July 17-18, 2017, Lisbon, Portugal
  - [7th World Congress on Healthcare and Technologies \(Healthcare Summit 2016\), September 26-27, 2016, London, UK](#)
  - (IEEE/EII) 2011 International Conference on Applied and Engineering Mathematics
- 程序委员会委员
  - [The Thirteenth International Conference on Digital Telecommunications \(ICDT 2018\)](#), April 22-26, 2018, Athens, Greece
  - [2017 the 7th International Conference on Power and Energy Systems](#), November 1-3, 2017, Toronto, Canada
  - [The 12th International Conference on Queueing Theory and Network Applications \(QTNA2017\)](#), August 21-23, 2017, Qinhuangdao, China
  - [The Twelfth International Conference on Digital Telecommunications \(ICDT 2017\)](#), April 23 - 27, 2017, Venice, Italy
  - [17th IEEE International Conference on Communication Technology \(ICCT 2017\)](#), Oct 27-30, 2017, Chengdu, China



- 6th International Conference on Power and Energy Systems (ICPES 2016), November 15-18, 2016, Paris, France
- The 2nd Int'l Conference on Partial Differential Equations (ICPDE 2016), Suzhou, 2016
- 2016 3rd International Conference on Computer Science and Application, November 12-13, 2016, China
- IEEE ICC 2016 - Cognitive Radio and Networks Symposium, 2016
- The 12th International Conference on Wireless Communications, Networking and Mobile Computing (WiCOM 2016), September 25-27, 2016
- The Second International Symposium on Computer Vision and the Internet (VisionNet 2015), Kerala, 2015
- International Conference on Information Engineering (ICIE 2015), Beijing, 2015
- The 2nd International Conference on Mathematics Research and Application (ICMRA2014)
- International Conference on Applied Mathematics and Statistics Research (2014)
- The 1st International Conference on Computer Science and Application (ICOCSA 2014)
- International Conference on Electrical, Control and Automation (2014)
- International Conference on Mathematics and System Science (2013)
- 2013 Conference on Computational Mechanics
- 2013 International Conference on Materials Science and Applied Mechanics
- 2<sup>nd</sup> International Conference on Control Engineering and Communication Technology (2013)
- 2013 International Conference on Management and Information Technology
- 1<sup>st</sup> International Conference on Mechanical Engineering and Material Science (MEMS 2012)
- 2012 IEEE International Conference on Control Engineering and Communication Technology
- (IEEE/EII) 2012 Spring World Congress of Engineering and Technology
- 2012 International Conference on Electronics, Information and Electrical Engineering
- 2012 IEEE International Conference on Electronics Design, Systems and Applications
- 2012 IEEE Conference on Control, Systems & Industrial Informatics
- 2012 IEEE Symposium on Wireless Technology & Applications
- (IEEE/EII) 2011 World Congress of Engineering and Technology

## 诸多杂志及出版物的审稿人

- IEEE Transactions on Automatic Control
- IEEE Transactions on Mobile Computing
- Operations Research

- Queueing Systems
- Journal of Applied Probability and Statistics
- Mathematical and Computer Modelling of Dynamic Systems
- Performance Evaluation
- Zentralblatt MATH
- Mathematical Reviews
- Mathematical Journal
- Journal of Applied Mathematics and Computing
- International Journal of Modern Mathematics
- Engineering Mathematics
- Journal of Systems Science and Complexity
- Systems Engineering: Theory and Practice
- IEEE INFOCOM Workshop on Cognitive & Cooperative Networks
- American Control Conference
- European Control Conference
- WRI International Conference on Communication and Mobile Computing
- International Conference on Bioinformatics and Biomedical Engineering
- International Conference on Network Computing and Information Security
- International Conference on Multimedia and Signal Processing
- IEEE Asia-Pacific Conference on Applied Electromagnetics
- IEEE Symposium on Wireless Technology & Applications
- IEEE International RF and Microwave Conference
- The International Conference on Automatic Control Theory and Application (ACTA 2014), Bangkok, 2014 ( <http://www.actaconf.org/>)
- etc.

## 主要基金资助项目

- 基于大数据智能云广义物联网的资源最优博弈与均衡控制(2018.1-2021.12, 主持人), 国家自然科学基金数理学部(并与信息科学部交叉)资助的面上项目.
- 未来无线网络中的随机系统与最优资源-性能控制(2014.1-2017.12, 主持人), 国家自然科学基金数理学部(并与信息科学部交叉)资助的面上项目.
- 4G 无线通信中的最优动态资源配置与数据包调度(2010.1-2012.12, 主持人), 国家自然科学基金数理学部(并与信息科学部交叉)资助的面上项目.
- 具有基站合作的无线系统的最优资源配置与调度(2009.6—2011.6, 主持人), 计算机软件新技术国家重点实验室资助的项目.
- 现代信息系统中随机网络的理论、方法及应用(2004.1—2006.12, 主持人), 国家自然科学基金数理学部(并与信息科学部交叉)资助的面上项目.
- 具有有限缓存容量多类别服务对象的网络建模与实现(2000.1-2002.12, 主持人), 教育部及南京大学
- SimNet (1996-1998, Principal Investigator 或称首席科学家和研究员), 美国 Lucent Technologies Bell Labs/Network Systems 资助的数百万美元多部门参与的重点研究与开发项目(Multi-million US dollar and multi-organization

- lightning R&D project, 所得成果获得了内部技术转让(Technology Transfer))
- IMA awarded funds for long term participant and 9 workshops (or tutorials) in the years of 1994, 2004, and 2012
- 等等

## 主要论文指导与获得基金资助的核心课程

- 博士后论文指导
  - 姓名: 吕学斌
  - 出站报告题目: Fractional Levy Noises and Stochastic (Ordinary and Partial) Differential Equations (December, 2011, Nanjing University)
- 南京京大学资助的研究生核心课程: 随机过程

## 任教的研究生与本科生课程

- 概率论与随机分析类课程
  - 随机微分方程
    - ◇ 自 2007 年, 每年春季开设
  - 随机过程
    - ◇ 自 2000 年, 每年秋季开设
  - 分析概率论
  - 概率论
  - 应用随机过程
- 运筹学及与概率论交叉类课程
  - 随机运筹学
  - 积分总体最优化
- 统计学类课程
  - 时间序列分析
    - ◇ 开设 3 次
  - 统计计算与软件
    - ◇ 开设 3 次
  - 数理统计
  - 概率论与数理统计
- 等等

## 特邀大会主旨报告(50 分钟左右)

- 2018 Spring World Congress on Engineering and Technology, April 23-25, 2018, Quilin, China
- 7th International Conference on Power and Energy Systems, November 1-3, 2017, Toronto, Canada
- 2017 International Symposium on Applied Mathematics and Statistics (AMS 2017), September 24-26, 2017, Suzhou, China
- [2017 Spring World Congress on Engineering and Technology](#), April 18-20, 2017,

Chengdu, China

- 题目与摘要: [Scheduling Game with Cloud-Computing Pools for Big Data: Fairness and Pareto Optimality](#)
- [2017 International Symposium on Computational and Applied Mathematics \(ISCAM 2017\)](#), February 26-28, 2017, Sanya, China
  - 题目与摘要: [MIMO Mutual Information Computation and Pareto Optimality of Scheduling Game by Reflecting SDEs](#)
- International Conference on Intelligent Cloud Computing (ICC 2016), December 17-18, 2016, Wuhan, China
- 3rd International Conference on Computer Science and Application, November 12-13, 2016, Changsha, China
- International Conference on Wireless Communications and Network Technology (ICWCNT2016), June 25-27, 2016, Guangzhou, China
- International Conference on Network and Communication Security (NCS 2016), June 11-12, 2016, Beijing, China
- 2016 Spring World Congress on Engineering and Technology, April 17-19, Suzhou, China
  - 题目: Signal Processing and Queue Scheduling vs. FB-SDEs with Levy Jumps and Skew Reflections
- 5th Int'l Conference on Signal and Image Processing (CSIP 2016), March 2-4, 2016, Beijing, China
- 2015 Co-located and Interacted International Conferences on: Partial Differential Equations, Functional Analysis, Ordinary Differential Equations and Dynamical Systems, Groups and Algebras, Probability and Stochastic Analysis, Statistics and its Applications, July 19-21, 2015, Shanghai, China
  - 题目: A Unified B-SPDE with Jumps vs. A System of Coupled FB-SDEs with Skew Reflections: Theory and Applications
- Spring World Congress of Engineering and Technology, 2015
  - 题目: A unified B-SPDE with Levy jumps: well-posedness, algorithm with numerics, and applications
- 2014 Spring World Congress of Engineering and Technology
  - 题目: Adapted solution, numerical methods and analysis via Malliavin calculus for a unified B-SPDE and their applications in finance
- 2013 Spring World Congress of Engineering and Technology
  - 题目: Optimal rate scheduling via utility-maximization for J-user MIMO Markov fading wireless channels with cooperation
- 2008 年 International Institute for General Systems Studies in China 第一届概率统计年会
- 2002 年第 7 届中国概率统计大会
- 等等

## 特邀大会分会和大会分组学术报告(30 分钟左右)

- BIT's 3rd Annual World Congress of Smart Material-2017, March 16-18, 2017,

Bangkok, Thailand

- 题目：Smart Storage and Processing of Quantum Particles in Cloud-Computing with Multi-Pools for Big Data
- [Probability theory and related fields](#), December 26-29, 2016, Shenzhen, China
  - 题目：Functional Limits for TSRRPs and SDEs with Skew Reflections
- SPDEs/SDEs and Stochastic Systems with Control/Optimization and Applications under The 11<sup>th</sup> AIMS Conference on Dynamical Systems, Differential Equations and Applications, July 1 - July 5, 2016, Orlando, Florida, USA
  - 题目：A Unified System of SPDEs with Levy Jumps vs. Stochastic Differential Games
- 8th ICIAM (International Congress of Industrial and Applied Mathematics), Beijing, 2015
- 8th International Annual Conference of Chinese Scholars Association for Management Science and Engineering (CSAMSE) July 25-27, 2015, Shenyang, China
  - 题目：Queues and Stochastic Differential Games by Coupled FB-SPDEs/FB-SDEs with Jumps and Skew Reflections
  - Institute of Mathematical Statistics (IMS)-China, Kunming, China, 2015 Workshop on Markov Processes and Stochastic Models, Changsha, China, 2015
- 题目：A Unified B-SPDE with Jumps, Queues, and Stochastic Differential Games
- 4th Annual World Congress of Advanced Materials, Chongqing, China, 2015
  - 题目：Unified SPDEs with Applications in Advanced Semiconductors and Smart IT Materials
- The 10th AIMS (American Institute of Mathematical Sciences) Conference on Dynamical Systems, Differential Equations and Applications, Madrid, Spain, 2014
- IMS (Institute of Mathematical Statistics)-China 2013
- INFORMS International Beijing 2012
- INFORMS International Hong Kong 2006
- International Conference of Management Science and Applications, 2005
- 12th Informs Applied Probability Conference, Beijing, 2004
- 8th Informs Applied Probability Conference, Atlanta, U.S.A., 1995
- etc.

## 近期邀请及其它学术报告

- International Congress of Mathematicians (ICM) 2014, Coex, Seoul, Korea, August 13-21, 2014
- 20th Conference of The International Federation of Operations Research Societies (IFORS 2014), Barcelona, Spain, 2014
- 2013 IMA Theory and Applications of Stochastic PDEs, Minneapolis, U.S.A., 2013

- 8th World Congress on Probability and Statistics, Istanbul, Turkey, 2012
- IMA Workshop on Random Dynamic Systems, Minneapolis, U.S.A., 2012
- IEEE/EII 2011 Conference on Applied and Engineering Mathematics, 2011
- IEEE/EII 2011 World Congress of Engineering and Technology, 2011
- 2011 International Conferences on Network Computing and Information Security and on Multimedia and Signal Processing, 2011
- 9th Annual Conference of Chinese Probability and Statistics Society, 2010
- WRI International Conference on Communication and Mobile Computing, 2009
- International Conference on Bioinformatics and Biomedical Engineering, 2009
- 8th Annual Conference of Chinese Probability and Statistics Society, 2006
- Stochastic Networks Conference, Stanford University, U.S.A., 2002
- 10th International Congress on Computational and Applied Mathematics, University of Leuven, Belgium, 2002
- International Congress of Mathematicians (ICM) 2002, Beijing, China, 2002
- etc.

## 一些研讨班的邀请学术报告

- 中国科学院数学与系统科学研究院
- 国防科技大学
- 北京邮电大学
- 河海大学
- 美国数学及其应用研究所(IMA)
  - Institute of Mathematics and Its Applications, University of Minnesota, U.S.A.
- 等等

## 代表作

- “Mean-variance hedging based on an incomplete market with external risk factors of non-Gaussian OU processes”, Mathematical Problems in Engineering, Volume 2015 (Regular Issue), Article ID 625289, 20 pages,, 2015 (SCI (3 区), EI)
  - “Optimal hedging and its performance based on a Levy driven volatility model”, Proceedings of International Conference on Applied Mathematics and Sustainable Development - Special track within 2012 Spring World Congress of Engineering and Technology, Scientific Research Publishing, 44-49 (related conference paper), 2012 (ISTP)
- “Optimal control with monotonicity constraints for a parallel-server loss channel serving multi-class jobs”, Mathematical and Computer Modeling of Dynamical Systems, Vol. 20, No. 3, 284-315, 2014 (SCI (3 区), 获 Taylor & Francis 数学与统计学 2015 读者奖提名奖)
  - “Constrained optimal control for a parallel-server channel serving multi-class jobs in zero-buffer regime”, Proceedings of 2011 World Congress of Engineering and Technology, Vol.1, 249-254 (related conference paper),

IEEE Computer Society Press, 2011

- “Product-form solutions for integrated services packet networks and cloud computing systems”, *Mathematical Problems in Engineering*, Volume 2014 (Regular Issue), Article ID 767651, 16 pages, 2014 (SCI (3 区), EI)
  - “Product-form solutions for integrated services packet networks”, *Proceedings of MICAI 2006*, IEEE Computer Society Press, pp. 296-308 (short conference version), 2006 (EI)
- “Optimal rate scheduling via utility-maximization for J-user MIMO Markov fading wireless channels with cooperation”, *Operations Research*, Vol. 61, No. 6, 1450-1462 (with 26 pages online e-companion ( Supplemental)), 2013 (SCI (2 区), SSCI (2 区), 商学院 (1 区), (2015 SCI A 区), EI, 运筹学及管理科学界公认国际顶尖杂志, 已获包括国际顶尖科学实验室与法国、巴西、韩国等多国作者及 *IEEE Transactions on Mobile Computing* 杂志论文的 8 次引用(以 Google 搜索为准, 以下同))
  - “Functional limit theorems based on doubly stochastic renewal processes and optimal controls for wireless systems under random environment” (an alternative title used in some Probability and Statistics Conference)
- “Stochastic integration for fractional Levy process and stochastic differential equation driven by fractional Levy noise”, *ACTA Mathematica Scientia (A): Chinese Series (Journal of Mathematical Physics, Series A)*, Vol. A33, No. 6, 1022-1034, 2013 (jointly with Lu) (2001 年被确定为中国 100 个杰出学术期刊中数学类的三个杰出期刊之一, 已获包括德国学者及 *Stochastic Processes and Their Applications* 杂志论文的 4 次引用 )
  - English version available at <http://arxiv.org/abs/1307.4173>
- “Heavy traffic limit theorems for a queue with Poisson ON/OFF long-range dependent sources and general service time distribution”, *Acta Mathematicae Applicatae Sinica, English Series*, Vol. 28, No. 4, 807-822, 2012 (SCI (4 区), 已获 6 次引用)
- “Mean-variance portfolio selection based on a generalized BNS stochastic volatility model”, *International Journal of Computer Mathematics*, Vol. 88, No. 16, 3521-3534, 2011 (SCI (4 区), (2015 为 3 区), 已获 5 次引用)
- “Generalized fractional Levy random fields on Gelfand triple: a white noise approach”, *Front. Math. China*, Vol. 9, No. 3, 493-506, 2011 (jointly with Lu and Huang) (SCI (4 区))
- “On the conflict of truncated random variable vs. heavy-tail and long range dependence in computer and network simulation”, *Journal of Computational information Systems* 7:5, 1488-1499, 2011 (EI, 已获包括美欧学者及 *Communications in Nonlinear Science and Numerical Simulation* 及 *Operations Research* 杂志论文的 8 次引用)
- “Stochastic optimal controls for parallel-server channels with zero waiting buffer capacity and multiclass customers”, *Journal of Advances in Systems Science and Applications*, Vol. 9, No. 4, 627-646, 2009 (jointly with Feng) (Scopus, 获国际一般系统论研究会 (IIGSS) 首届中国概率统计年会优秀论文一等奖 (2008), 已获 1 次引用)

- “On the traveling neuron nets (human brains) controlled by a satellite communication system”, Proceedings of International Conference on Bioinformatics and Biomedical Engineering (ICBBE 2009), pp. 1-4, IEEE Computer Society Press, 2009 (EI)
- “Optimal control based on a generalized exponential scheduling rule for a generalized switch”, Proceedings of International Conference on Communications and Mobile Computing 2009, IEEE Computer Society Press, Vol. 2 332-336, 2009 (jointly with Wang) (EI, 已获 1 次引用)
- “Stochastic optimal control of ATO systems with batch arrivals via diffusion approximation”, Probability in the Engineering and Informational Sciences, 21, 477-495, 2007 (jointly with Jiang) (SCI, 该年分区情况未知, 2014 年为 4 区, 已获 2 次引用)
- “Diffusion approximations for multiclass queueing networks under preemptive priority service discipline”, Applied Mathematics and Mechanics, 28 (10), 1331-1342, 2007 ((SCI, 该年分区情况未知, 2016 年为 3 区, 已获包括他引在内的 4 次引用))
- “Finite element density estimator with multi-stage adaptive filters”, Chinese Journal of Engineering Mathematics, 23, 1068-1074, 2006 (中文核心期刊)
- “A Brownian model for multiclass queueing networks with finite buffers”, Journal of Computational and Applied Mathematics 144/1-2, pp 145-160, 2002 (SCI, 该年分区情况未知, 2015 年为 2 区, 已获包括多名瑞士作者在内的 4 次引用)
- “The finite element method for computing the stationary distribution of an SRBM in a hypercube with applications to finite buffer queueing networks”, Queueing Systems 42, pp 33-62, 2002 (jointly with Chen, J.G. Dai and Shen) (SCI, 该年分区情况未知, 2016 年为 3 区, 排队论学会顶尖杂志, 多篇世界数学家大会 45 分钟特邀报告论文发表在此杂志上, 已获包括美国工程院院士、IEEE 会士在内的 40 次引用)
- “A heavy traffic limit theorem for a class of open queueing networks with finite buffers”, Queueing Systems 32, pp 5-40, 1999 (jointly with J.G. Dai) (SCI, 该年分区情况未知, 2016 年为 3 区, 排队论学会顶尖杂志, 多篇世界数学家大会 45 分钟特邀报告论文发表在此杂志上, 已获包括美国院士在内的 64 次引用)
  - 该文(包括当时的预印本(preprint))及上一篇文章作为一整体得到了国际同行论文的多次沿用、发展和应用, 其中包括 1 位美国科学院院士的论文、2 位美国工程院院士的论文、1 位美国科学与艺术院院士的论文、INFORMS Lanchaster 奖得主的论文、3 位 INFORMS John von Neumann 奖得主的论文、数学界中最有权威最有影响的世界数学家大会概率统计方面 45 分钟特邀报告者的会议论文(1998 年)和该报告者的其它 4 篇次突破性的重要论文(该报告者也是美国科学院院士, 美国数学学会 (AMS) Fellow, INFORMS Fellow 与 INFORMS John von Neumann 奖及应用概率最佳论文得主)、另一 IEEE Fellow 与 INFORMS 应用概率最佳论文得主的有关复杂网络控制技术的专著《Control Techniques for Complex Networks》、《Queueing Systems》杂志前主编的论文、《Operations Research》杂志随机模型 2 位区域主编(Area Editor)的 4 篇重要论文、国



际数理统计学会(IMS)前任理事长( Prsident)的论文与 INFORMS 应用概率学会 3 位前理事长(Chair)的重要论文等等.

- “SimNet”, Internal Technical Report for Technical Transfer of SimNet within Lucent Technologies Bell Labs/Network Systems, New Jersey, U.S.A., 1998 (one of the co-authors, due to the consideration of high-tech intellectual property control, the report is prohibited to be published publicly)
- “Brownian approximations for queueing networks with finite buffers: modeling, heavy traffic analysis and numerical implementations”, UMI Dissertation Service(Publishing Number, UMI Number 9714724), A Bell &Howell Company, 300 N. Zeeb Road, Ann Arbor, Michigan 48106, U.S.A., 1997 (该文已有获包括美国院士、世界数学家大会 (1998 年) 概率统计方面 45 分钟特邀报告者在内的 15 次引用)
  - 该文中我们首次创立了通过证明振荡不等式、不变原理、鞅收敛定理、饱和传输定理的弱收敛方法证明了具有有限缓冲容量的队长过程可由一类反射扩散过程 (半鞅反射布朗运动) 来逼近的泛函极限定理, 该证明方法克服了由于相应的有关 Skorohod 问题解的不唯一性而导致已有证明方法不可用的困难, 为该领域提供了全新的证明方法。我们首次在 1995 年 INFORMS 应用概率年会上已对此方法作了邀请报告并分发了正式的 Preprint 给诸多与会者且于 1996 年发表了正式的博士论文. 之后, 在数学界中最具权威最有影响的世界数学家大会 (1998 年) 上特邀了 Williams 作了概率统计方面的 45 分钟报告, 介绍了利用此法与另一 45 分钟特邀报告者的有关结论解决了有关多类排队网络的随机扩散逼近问题, 由于 Williams 所解决问题的核心难点也是有关 Skorohod 问题解的不唯一性, 因而在她相应突破性的成果中指出了她的成果与我们的成果是同时期相互独立做出的. Williams 现已晋升美国院士及美国科学艺术院院士.
- “A heavy traffic limit theorem for queueing networks with finite capacity”, Proceedings of Third International Workshop on Queueing Networks with Finite Capacity, West Yorkshire, U.K., July 6-7, 1995 (jointly with J.G. Dai)
- “Estimating time-variable parameters by the least squares algorithm with a variable forgetting factor: convergence and stability”, Proceedings of Asia-Pacific Conference on Measurement and Control, Vol.2, 544-547, 1991 (获得包括 IEEE 论文在内的他人引用)
- “Stochastic adaptive control for time-varying systems convergent at the rate of  $1/t$ ”, IFAC Proceedings Series v 1 n 8, pp 179-184, Pergamon Press, Elmsford, NY, U.S.A., 1989 (EI, 已获 2 次引用)

## 最近完成的代表作

- “A new class of backward stochastic partial differential equations with jumps and applications”, 2011 (under review, presented in 2011 Annual Conference of Jiangsu Probability and Statistical Society and 2012 8<sup>th</sup> World Congress of Probability and Statistics, and early version is available through <http://arxiv.org/pdf/1105.0881v1.pdf>)
- “Numerical methods and analysis via random field based Malliavin calculus for

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- “Stochastic Partial Differential Equations Driven by Fractional Levy Noises”, 2014 (jointly with Lu, under review), online available at <http://arxiv.org/pdf/1410.0992v1.pdf>
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