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Academic Qualification:

Ph.D. in Mathematics, Peking University, China, 1984

Master in Mathematics, Peking University, China, 1981

Teaching Area

B.Sc. Courses

Complex Analysis

Mathematical Analysis III

Mathematical Analysis IV

Mathematical Physics Methods

Functional Analysis

Real Analysis

M.Sc. Courses

Mathematics Seminar

Real Analysis

Clifford Analysis

Functional Analysis

Partial Differential Equations

Topics in Partial Differential Equations

Fourier Analysis

Advanced Mathematics

Introduction to Statistics

Research Area

Harmonic Analysis in Euclidean Spaces

Partial Differential Equations

Complex Analysis of One and Several variables

Clifford Analysis

Time-Frequency Analysis

System Identification

Signal and Image Processing (Edge Detection)

Working Experience

2019 - present Professor, Macau University of Science and Technology

2013 - 2019 Distinguished Professor, University of Macau

2003 - 2012 Full Professor, University of Macau

2005 - 2011 Head of Dept of Math, Full Professor, University of Macau

2000 - 2002 Associate Professor, University of Macau

1992 - 2000 Senior Lecturer, Lecturer (English system), University of New England, Australia

1988 - 1992 Research Fellow, Flinders University of South Australia, Australia

1986 - 1988 Research Fellow, Macquarie University, Australia
1984 - 1986 Research Fellow, Institute of Systems Sciences, the Chinese Academy of Sciences

Google Scholar Address

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Academic Publication

Accepted and Published Refereed Journal papers

("*" means that the paper is in the latest SCIE, EI, CPCI-S and CJCR (China Journal of Scientific Research) lists. Percentage of the applicants contribution is cited to the end of the item. Before 2000 the authors name order was according to the alphabetical way, and after 2000 it was according to variable criteria and requests of the collaborat

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- [*211\[WLQ\] H. T. Wang, I. T. Leong, T. Qian, Adaptive rational approximation in Bergman space on bounded symmetric domain, J. Math. Anal. Appl., 2022, 506\(1\).](#)
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- [*209\[LJCQ\] D. Li, F. X. Jiang, M. Chen, T. Qian, Multi-step-ahead wind speed forecasting based on a hybrid decomposition method and temporal convolutional networks, Energy, 2022, 238.](#)

2021

- [*208\[WLZQX\] Y. F. Wu, X. L. Liu, L. M. Zhang, T. Qian, Q. W. Xie, Content-adaptive image encryption with partial unwinding decomposition, Signal Processing, 2021, 181.](#)
- [*207\[QQH\] 钱涛, 曲伟, 黄勇, 算子方程基本问题解的再生核稀疏表示, 中国科学:数学, 2021, 51\(01\): 209-224.](#)
- [*206\[YQZDB\] Z. J. Ye, T. Qian, L. M. Zhang, L. Dai, H. Li, J. A. Benediktsson, Functional Feature Extraction for Hyperspectral Image Classification With Adaptive Rational Function Approximation, IEEE Transactions on Geoscience and Remote Sensing, 2021, 59.](#)
- [*205\[WQ3\] Y. B. Wang, T. Qian, Pseudohyperbolic distance and n-best rational approximation in \$H_2\$ space, Mathematical Methods in the Applied Sciences, 2021.](#)
- [*204\[DHQ\] G. T. Deng, Y. Huang, T. Qian, Reproducing Kernels of Some Weighted Bergman Spaces, Journal of Geometric Analysis, 2021.](#)
- [*203\[TZWQ\] C. Y. Tan, L. M. Zhang, H. T. Wu, T. Qian, A novel feature representation approach for single-lead heartbeat classification based on adaptive Fourier decomposition, International Journal of Wavelets, Multiresolution and Information Processing, 2021.](#)
- [*202\[QTC\] T. Qian, L. H. Tan, J. C. Chen, A class of iterative greedy algorithms related to Blaschke product, SCIENCE CHINA-MATHEMATICS, 2021.](#)
- [*201\[QWZ\] T. Qian, X. Y. Wang, L. M. Zhang, MIMO frequency domain system identification using matrix-valued orthonormal functions, Automatica, 2021, 133.](#)
- [*200\[QQD\] W. Qu, T. Qian, G. T. Deng, A stochastic sparse representation: n-best approximation to random signals and computation, Applied and Computational Harmonic Analysis, 2021, 55: 185-198.](#)
- [*199\[XLQL\] Q. W. Xie, R. R. Liu, T. Qian, J. Y. Li, Linkages between the international crude oil market and the Chinese stock market: A BEKK-GARCH-AFD approach, Energy Economics, 2021, 102.](#)

2020

- [*198\[CLQ\] Q. H. Chen, L. Q. Li, T. Qian, Time-frequency transform involving nonlinear modulation and frequency-varying dilation, COMPLEX VARIABLES AND ELLIPTIC EQUATIONS, 2020, 65\(11\): 1800-1813 .](#)
- [*197\[DMQ\] P. Dang, W. X. Mai, T. Qian, Fourier spectrum of Clifford \$H_p\$ spaces on \$R^{n+1}\$ for \$1 < p \leq \infty\$, Journal of Mathematical Analysis and Applications, 2020, 483\(1\).](#)
- [*196\[YQ\] Q. X. Yang, T. Qian, The Dual Elements of Function Sets and Fefferman-Stein Decomposition of Triebel-Lizorkin Functions via Wavelets, COMPUTATIONAL METHODS AND FUNCTION THEORY, 2020, 20\(2\): 185-216.](#)
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- [*194\[CQT\] Q. H. Chen, T. Qian, L. H. Tan, A theory on non-constant frequency decompositions and applications, Advancements in Complex Analysis: From Theory to Practice, 2020: 1-37.](#)
- [*193\[FLQ\] W. Y. Fu, X. D. Li, T. Qian, AFD-based ILC designs in frequency domain for linear discrete-time systems, INTERNATIONAL JOURNAL OF SYSTEMS SCIENCE, 2020, 51\(16\): 3393-3407.](#)
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- *189[Q2020]T. Qian, Reproducing Kernel Sparse Representations in Relation to Operator Equations. Complex Anal. Oper. Theory, 2020, 14(2): 1–15.
- *188[DMQ] P. Dang, W. X. Mai, T. Qian, Fourier spectrum of Clifford H_p spaces on R^{n+1} for $1 \leq p < \infty$, J. Math. Anal. Appl., 2020, 483(1): 123598.

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- *186[TZQ]C. Y. Tan, L. M. Zhang, T. Qian, A New Supervised Learning Approach: Statistical Adaptive Fourier Decomposition (SAFD), Communications in Computer and Information Science, 2019, 1143:397-404.
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- [*117\[QChen\] T. Qian, Q. H. Chen, Rational Orthogonal Systems are Schauder Bases, Complex Variables and Elliptic Equations, 2014, 59\(6\): 841–846.](#)
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- [*110\[LQ2\] S. Li, T. Qian, On Sparse Representation of Analytic Signal in Hardy Space, Mathematical Methods in the Applied Sciences, 2013, 36\(17\): 2297–2310.](#)
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6. 自适应 Fourier 变换, by Qian, T., 科学出版社.

2012

5. Complex Variables and Elliptic Equations, by T. Qian and Z.H. Du, accepted to appear in 2012.

4. Mathematical Methods in the Applied Sciences, by T. Qian, I.T. Leong, 30 November 2012 Volume 35, Issue 17 1999-2140, Special Issue: Complex Analytic Methods in Signal Processing

2007

3. Communication on Pure and Applied Analysis , by T. Qian and Y. S. Xu (Editors), invited as guest editor for the issue 6 (3), 2007.

2. Wavelet Analysis and Applications, by T. Qian, V. M. I and Y. S. Xu (Editors), the book series in Applied and N Harmonic Analysis, Springer, 2007.

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1. Advances in Analysis and Geometry, by T. Qian, T. Hempfling, A. McIntosh and F. Sommen (Editors) ,book ser Trends in Mathematics, Birkhäuser, 2004.

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11. Sparse Representation of Signals in Hardy Space, Quaternionic and Clifford Fourier Transforms and Wavelets, Eckhard Hitzer and Stephen J. Sangwine, Trends in Mathematics, Birkh"user, 2013.

10. [bookchapter10] HOW TO CATCH SMOOTHING PROPERTIES AND ANALYTICITY OF FUNCTIONS B COMPUTERS, L.P. Castro, H. Fujiwara, T. Qian and Saburo Saitoh, MATHEMATICS WITHOUT BOUNDARY SURVEYS IN INTERDISCIPLINARY RESEARCH, Edited by Panos Pardalos and Themistocles M. Rassias, volume will be published by Springer in 2014.

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9. Hilbert Transforms on the Sphere and Lipschitz Surfaces, by T. Qian, Quaternionic and Clifford Analysis, Trend Mathematics, Birkhäuser Verlag Basel/Switzerland, 259-275, 2008.

2007

8. Mono-components for signal decomposition, book series in Applied and Numerical Harmonic Analysis, Springer

7. Time-frequency aspects of nonlinear Fourier atoms, by T. Qian, Q. H. Chen and L. Q. Li, the book series in Appl Numerical Harmonic Analysis, Springer, 2007.

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6. Advances in Analysis and Geometry, by T. Qian, T. Hempfling, A. McIntosh and F. Sommen (Editors), bookser Trends in Mathematics, Birkhäuser, 2004.

5. Dini-type convergence of Fourier series on the unit sphere of Euclidean spaces, by T. Qian and S. Liu, book seri Trends in Mathematics, Birkhäuser, 2004, pp131-148.

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4. Singular Integrals and Fourier Multipliers On the Unit Spheres and Their Lipschitz Perturbations, *Advances in Clifford Algebras*, Vol 11, (S1) 53-76, November (2001)– Special Issue, Clifford Analysis Proceedings of the Clifford Analysis Conference, Cetraro, Italy, October, 1998, John Ryan and Daniele C. Struppa Editors.

2000

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1991

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Conference Proceedings

2012

16. Sparse Reconstruction of Signals in Hardy Spaces, S. Li and T. Qian, the proceedings of QCFTW (of ICCA9) for TIM/Birkhäuser, edited by Eckhard M. S. Hitzler and Steve Sangwine.

2011

15. An adaptive method of model reduction in frequency domain, by Mi Wen and T. Qian, *IEEE Power Engineering Automation Conference (PEAM 2011)*, Sep, Wuhan.

14. Adaptive Fourier Transform Based Signal Denoising, by Zhang, L. M. & Li, H. and Qian, T. (2011). *ICSP 2011 International Conference on Signal Processing*.

13. Instantaneous Frequencies of Simple Waves and Their application to Sleep Spindle Detection, by Zhang, L. M. Wei, Y. T. & Qian, T., *Proceedings of 2011 IEEE International Conference on Systems, Man, and Cybernetics (2011)*.

12. Non-harmonic system with greedy algorithm, by S. Li and T. Qian, accepted to appear in the *International Workshop on Electromagnetism and Communication Engineering*. (ECE 2011), IEEE Catalog Number: CF1143k-DVD, ISBN: 4244-9438-5, Conference Code: #18262

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11. Frequency Domain Identification with Adaptive Rational Orthogonal System, with M. Wen, *Proceedings of 2010 International Conference on System Science and Engineering*, Taiwan.

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10. A new property of Nevanlinna Functions, by T. Qian, *Proceedings of the 16th International Conference of Finite and Infinite Dimensional Complex Analysis and Applications*, Dongguk University, Gyeongju, KOREA, July 28-Aug 2008, pp 38-49.

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9. A mathematical model for edge detection using rotational wavelet transformation, by T. Qian and L. M. Zhang, *Proceedings of IASTED International Conference on Computers, Graphics, and Imaging*, August 13-15, 2003, Honolulu, USA.

8. Parameter Analysis of Morlet Wavelet Transform Based Edge Detection, by T. Qian and L. M. Zhang, *Proceedings of 7th WSEAS Int. Conf. on CSCC (Circuits, Systems, Communications and Computers)* in Corfu Island, Greece, June 2003.

7. Derivation of monogenic functions and applications, *Proceedings of the Centre for Mathematics and its Applications, Australian University*, Volume 41, 2003, 118-127.

2002

6. Radon measure formulation of edge detection using rotational wavelets, by T. Qian and L. M. Zhang, *Proceedings of WSEAS conference*, Singapore, December, 2002.

5. Paley-Wiener theorem and Shannon Sampling in the Clifford analysis setting, *Proceedings of the 6th International Conference on Clifford Algebras and their Applications*, Invited Volume for Plenary Talks, May 20-25, 2002, Cookeville, Tennessee, USA.

1996

4. Singular integrals on star-shaped Lipschitz surfaces in the quaternionic space and generalisations to \mathbb{R}^n , Proceedings Symposium on Analytical and Numerical Methods in Quaternionic and Clifford Analysis, Seiffen, 1996, 187-196.

1994

3. Transference between infinite Lipschitz graphs and periodic Lipschitz graphs, Proceedings of the Center for Mathematics and its Applications, ANU, vol. 33 (1994), 189-194.

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2. A note on martingales with respect to complex measures, by T. Qian, M. Cowling and G. Gaudry, Miniconference on Operators in Analysis (1989), Proceedings of the Center for Mathematical Analysis, 24, ANU, Canberra, (1989)

1987

1. Fourier transform on Lipschitz curves, by T. Qian and A. McIntosh, Proceedings of the Center for Mathematical Analysis, vol. 15, (1987), 157-166.

Professional Society Membership

Member of the Australian Mathematical Society

Honorary Positions

Honorary Professor of Huaqiao University since 2011 by invitation

Honorary Professor of Wuhan University since 2005 by invitation

Honorary Professor of Xiamen University since 2003 by invitation

International Journal Editorial Board Positions

Associate Editor: Mathematical Methods in the Applied Sciences (SCI), published by Wiley-Blackwell

Associate Editor: Complex Analysis and Operator Theory (SCI), published by Birkhauser-Springer

Associate Editor: Complex Variables and Elliptic Equations (SCI), published by Birkhauser-Springer

Mathematical Conference Organization

To host ISAAC 2015 in University of Macau

Chair of Scientific and Organization Committees, the 18th International Conference on Finite and Infinite Complex Analysis and Applications, University of Macau, 2010 (120 speakers and two special issues with the SCI journals MMSA and CV&EE as related publications)

Chair of Scientific and Organization Committees, Symposium on Hyper-Complex Analysis, activity of Silver Jubilee of the University of Macau, December, 2006 (a conference proceedings published by Univ. of Macau)

Chair of Scientific Committee, the 4th International Conference on Wavelet Analysis and Applications, 29th November to 3rd December, 2005, University of Macau (with 150 speakers and a conference book published by Springer)

Chair of Scientific Committee, Satellite Conference to ICM2002

(International Congress for Mathematicians, 2002, Beijing) on Clifford Analysis and its Applications, August, 2002, University of Macau (a conference book published by Birkhäuser)

University and Faculty/Unit Service (Position Held, Dates, etc.)

Director of Macau Center for Mathematical Sciences from 2019 to present.

Head of Department of Mathematics for 6 years from 2005 to 2011.

Service as members of University Senate, University GSC and Faculty GSC.

Establishment of a New BSc Program in Mathematics with two branches in University of Macau

Before 2011 Dept of Math taught only service courses for BSc in Math Education of Faculty of Education, and service courses for engineering departments of Faculty of Science and Technology, and Master and Ph.D. programs in mathematics. Supported by the university authority, as Head of Dept of Math, I led colleagues in Dept of Math to establish a new program in mathematics in University of Macau with two streams (Mathematical Education and Mathematics and Applications). The program proposal has passed all the required procedures and become effective since November 2011. Dept of Math started to have freshmen for the new BSc in math.

AFD (Adaptive Fourier Decomposition) Algorithm Code Release

Introduction: AFD is a new decomposition model that decomposes a given signal/function into a sum of mono-co (signals of non-negative analytic phase derivative) with fast convergence in energy. Iteration based on AFD gives a conditional solution of the n-best rational approximation: a long standing open algorithm problem.

1. 1D AFD

[the agreement to obtain the code of our adaptive Fourier decompositions](#)

2. 2D PUD

[the agreement to obtain the code of 2D partial unwinding decompositions](#)

Research Experience

Major Research Grants Obtained From My Working Institutions (Active Research Grants are with thicker)

2018: Macao Government FDCT 0123/2018/A3, Theory and applications of adaptive fourier decomposition in rep Kernel Hilbert spaces.

2018: University of Macau Multi-Year Research Grant (MYRG) MYRG2018-00168-FST, **Adaptive rational approximation in weighted Hardy spaces and applications**, 1120700 MOP. Funding starts from January 2019.

2017: Macao Government FDCT 079/2016/A2, Studies and Applications of Unwinding Fourier Expansions of Sig Finding started in January 2018.

2016: University of Macau Multi-Year Research Grant (MYRG) MYRG2016-00053-FST AFD applications in Co Theory, 1458500 MOP.

Annual Research Grant for the position of Distinguished Professor: MOP 350000.

2015: Joined with 乔玉英 NSFC, 11571089, **Clifford分析中Dirac型算子及相关问题研究**.

2015: Joined with 张艳慧 NSFC, 11501015, **半空间中次调和函数的Matseav定理**.

2014: Macao Government FDCT 099/2014/A2, Two Related Topics in Clifford Analysis, Duration: 3 years, MOP

2013: Multi-Year Research Grant (MYRG) MYRG116(Y1-L3)-FST13-QT Adaptive Decomposition of Signals a Applications, Level iii project, MOP 120,0000

2013: Multi-Year Research Grant (MYRG) MYRG115(Y1-L4)-FST13-QT Variational Problem on sub-Riemanni geometry with Application in Harmonic analysis and PDE, Level iv research proposal, MOP 221,0000

2012: Macao Government FDCT 098/2012/A3, Approximation With Rational Functions In One and Higher Dime With Applications, approved MOP 168, 2850.

2011: Joined with 姜增建, NSFC, 11171203, 临界Q型空间及其在流体方程中的应用.

2011: Macao Government FDCT/056/2010/A3, Adaptive Decomposition of Signals and Applications (信号的自及其应用), Proposed Duration: 3 years. APPROVED MOP 1760000

2009 – 2010: UL017/08-Y3/MAT/QT01/FST, Applications of Hyper-Complex Analysis -1st Sub-project: Signal Proposed Duration: 5 years (3rd). Approved 401250 MOP

– 2010: Macao Government FDCT/014/2008/A1, Clifford and Harmonic Analysis Clifford及調和分析Proposed 3 years. APPROVED MOP\$ 1196000

– 2009: UL017/08-Y2/MAT/QT01/FST, Applications of Hyper-Complex Analysis -1st Sub-project: Signal Analy Proposed Duration: 5 years (2nd). Approved 195450 MOP

2007: Joined with 姜增建, NSFC, 10771130, Hardy-Sobolev空间及相关问题.

2007 – 2008: RG-UL/07-08S/Y1/QT/FST, Applications of Hyper-Complex Analysis – 1st Sub-project: Signal An Proposed Duration: Spring of 2008 to End of 2012. Approved 78000 MOP

-2007: RG071/06-07S/QT/FST, Singular Integrals in Hyper-complex Analysis. Proposed Duration: 2 years. Appro 195850 MOP

-2007: RG071/06-07S/08R/QT/FST, Singular Integrals in Hyper-Complex Analysis. Proposed Duration: 2 years. 31000 MOP

2005-2008: Macao Government FDCT/051/2005/A, Time-Frequency Representation and Realization of Algorithm Transient Signals (瞬變信號的時頻表示及算法實現), Proposed Duration: 3 years. APPROVED MOP\$ 500000.

Qihui Chen.

2005 -2006: RG059/05-06S/07R/QT/FST, Paley-Wiener and Shannon Sampling Theorems in Hyper-complex Ana Proposed Duration: 2 years. Approved 45176.6 MOP

2005 – 2006: RG059/05-06S/08T/QT/FST, Paley-Wiener and Shannon Sampling Theorems in Hyper-Complex A
Proposed Duration: 12 months. Approved 21440 MOP

2004 – 2005: RG059/05-06S/QT/FST (RG079/04-05S), Paley-Wiener and Shannon Sampling Theorems in Hyper
Analysis. Proposed Duration: Two year (The present one is the second half). Approved 85580 MOP

2004 – 2005: RG079/04-05S/QT/FST, Paley-Wiener and Shannon Sampling Theorems in Hyper-complex Analysis
Proposed Duration: 24 months. Approved 52170 MOP

2004 – 2005: RG091/04-05S/C117/QT/FST, Clifford Analysis Methods in Harmonic Analysis. Proposed Duratio
Approved 9487 MOP

2004 – 2005: RG092/04-05S/C118/QT/FST, Analysis Methods in Signal Processing. Proposed Duration: 2 years.
35355.8 MOP

2003 – 2004: RG065/03-04S/QT/FST, Analysis Methods in Signal Processing. Proposed Duration: 2 years. Appro
41700 MOP

2003 – 2004: RG021/03-04S/QT/FST (RG024/02-03S/...), Clifford Analysis Methods in Harmonic Analysis. Pro
Duration: 2 years. Approved 49800 MOP

2002 – 2003: RG024/02-03S/QT/FST, Clifford Analysis Methods in Harmonic Analysis. Proposed Duration: 2 ye
Approved 47440 MOP

2002 – 2003: RG080/02-03S/C41/QT/FST (RG055/01-02S...), Mathematical Formulation of Image Edge Detecti
Wavelet Method. Proposed Duration: 2 years. Approved 34040 MOP

2001 – 2002: RG055/01-02S/QT/FST (RG002/00-01W.), Monogenic Sinc Function and Applications (Jan to June
Harmonic Analysis on the Unit Spheres in Higher Dimensional Euclidean Spaces (Jul to Dec2002) Note: Project
under the title “Higher Dimensional Sine Methods and Applications in Partial Differential Equations” with a prog
Proposed Duration : one year. Approved 43900 MOP

2001 – 2002: RG056/01-02S/QT/FST, Mathematical Formulation of Image Edge Detection with Wavelet Method
Proposed Duration: 2 years. Approved 30900 MOP

2001 – 2002: RG056/01-02S/C19/QT/FST, Mathematic Sinc Function and Applications & Harmonic Analysis on
Spheres in Higher Dimensional Euclidean Spaces Note: Transfer from 2002 Funding to 2003. Approved MOP\$ 26

2000 – 2001: RG024/00-01S/QT/FST, Higher Dimensional Sine Methods and Applications in Partial Differential
– part 2 (previous ref. RG002/00-01W/QT/FST). Proposed Duration: 1year 3 months (parts 1&2). Approved 3991

2000 – 2001: RG002/00-01W/QT/FST, Higher Dimensional Sine Methods and Applications in Partial Differential
Equations. Proposed Duration: 1 year. Approved 11315 MOP

1993 – 1999 Research Grants obtained yearly from New England University, Australia.

Awards

澳门特别行政区科学技术奖：自然科学奖一等奖，二零一二年十月十九日

(Macao SAR Science and Technology Research Award: Natural Science First Prize, the 19th October, 2012)

Research Prize for Senior Faculty Members, Faculty of Science and Technology, University of Macau, 2007-2009

Second Research Competition of University of Macau with only one winner in the category)

2nd Prize of University of Macau Research Award, University of Macau, 2001 (My second year in UM, the first R
Competition of University of Macau)

Vice Chancellor’s Award for Excellency in Research, New England University, Australia, 2000 (One award after s
years)

Prize of Scientific Progress, China, 1984, 1985 (joint with M.T. Cheng and D.G. Deng, based on my Doctorate the