

XIANG-SUN ZHANG

Full Research Professor

Academy of Mathematics and Systems Sciences (AMSS)
Chinese Academy of Sciences (CAS)
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BRIEF VITAE

1. Family Name: Zhang
2. Given Name: Xiang-Sun
3. Citizenship: People's Republic of China
4. Birth Data and Place: May 13, 1943, Shanghai, China
5. Sex: male
6. Education and Affiliation:
 - 1965
Graduated from Department of Applied Mathematics, Chinese University of Science and Technology
 - 1965-1978
Research Assistant, Research Associate, Institute of Mathematics, Chinese Academy of Sciences, Beijing, China
 - 1979-1981
Research Associate, Institute of Applied Mathematics, Chinese Academy of Sciences, Beijing, China
 - 1981-1983
Visiting fellow, Department of Computer Science, University of Minnesota, Minnesota, U.S.A.
 - 1983-

Research Associate Professor, Full Research Professor, Institute of Applied Mathematics, Chinese Academy of Sciences (CAS), Beijing, China

1992-1998

Director, Institute of Applied Mathematics, CAS

1999-2003,2

Executive Vice President, the Academy of Mathematics and System Sciences (AMSS), CAS.

2002-

Director of the Research Center of Bioinformatics, AMSS

RESEARCH, TEACHING AND CONSULTING INTERESTS

Bioinformatics

Protein structure and function prediction
System biology

Optimization Theory and Application:

Nonlinear Programming,
Parametric Programming,
Global Convergence Algorithms,
Linear Programming and Combinatorics

Artificial Neural Network(ANN):

Mathematical analysis of ANN,
ANN solving optimization problems

Management Information System (MIS) Theory and Application:

MIS Design Methodology,
MIS Planning
E-Government Strategic Planning

AWARDS/HONORS

- [1] The Honorary President of the Operations Research Society of China.
- [2] First Prize of the "OR in Development", awarded by the International Federation of Operations Research Societies (IFORS) at the 14th International Conference at Vancouver, Canada, 1996.
- [3] Third Prize of The "Science and Technology development Award" of Chinese Academy of Sciences, 1996.
- [4] Second Prize of The "Science and Technology development Award" of Chinese Academy of Sciences, 1994.
- [5] Third Prize of The "National Natural Science Award" , 1988.
- [6] Second Prize of The "Science and Technology development Award" of Chinese Academy of Sciences, 1987.
- [7] First Prize of The "Science and Technology Achievement" of Chinese Academy of Sciences, 1981.

PROFESSIONAL EXPERIENCES

<u>Name</u>	<u>Position</u>
Operations Research Society of China (ORSC)	President (1996-2004) Honorary President (2004-)
APORS (Association of Asia-Pacific Operational Research Societies)	Representative of ORSC (1996-2004)
Chinese Society of Industrial and Applied Mathematics	Vice President (1996-2004)
Systems Science Society of China	Council member (1996-2003)
Journal of Global Optimization	Associate Editor
Systems Science and Mathematical Sciences	Standing Member of the Editorial Board
Bioinformatics Research Center, AMSS	Director, 2002-

<u>Name</u>	<u>Position</u>
The Degree Granting Committee of CAS	Member, 2000-2003
Key Laboratory of Management, Decision and Information System, CAS	Chairman of the Academic Committee, 2006-
Fuzzy Optimization and Decision Making	Associate Editor
Qingdao University	Honorary Professor
Xi'an Jiaotong University People's University of China Shanghai University Yunnan University Shangdong Uni. of Science and Technology	Concurrent Professor

INTERNATIONAL CONFERENCE ORGANIZING

- [1] Organizing Committee Chairman, Second Conference of the Association of Asia-Pacific Operational Research Societies within IFORS, (APORS'91), Aug. 1991, Beijing, China.
- [2] Symposium Chairman, Fifth Annual International Symposium on Algorithms and Computation, (ISAAC'94), 25-27, August, 1994, Beijing, China.
- [3] Symposium Chairman, First International Symposium on Operations Research with Applications in Engineering, Technology, and Management (ISORA), 19-22 August, 1995, Beijing, China.
- [4] Symposium Chairman, Second International Symposium on Operations Research with Applications in Engineering, Technology, and Management (ISORA'95), 11-14 December, 1996, Guilin, China.
- [5] Symposium Chairman, Third International Symposium on Operations Research with Applications in Engineering, Technology, and Management (ISORA'98), 20-22 August, 1998, Kunming, China.
- [6] Chairman of Local Organizing Committee, Fifteenth Conference of International Federation of Operations Research (IFORS'99), 16-21 August, 1999, Beijing, China.
- [7] Symposium Chairman, Fourth International Symposium on Operations Research with Applications in Engineering, Technology, and Management (ISORA'02),

- 1-6 June, 2002, Yichang-Chongqing, China.
- [8] Vice-Chairman of the Programming Committee, Game Theory and Applications satellite Conference, International Congress of Mathematicians, 14-17, August, 2002, Qingdao, China.
 - [9] Co-Chair of the Steering Committee of Sino-Japan Optimization Meeting, 25-27, September, 2002, Kyoto, Japan.
 - [10] Symposium Co-Chairman, Fifth International Symposium on Operations Research with Applications in Engineering, Technology, and Management (ISORA'05), Lhasa-Nyingchi, Tibet, China, 9-13 August, 2005, China.
 - [11] Symposium Co-Chairman, Sixth International Symposium on Operations Research with Applications in Engineering, Technology, and Management (ISORA'06), Urumqi, Xinjiang, 8-12 August, 2006, China.

INVITED PLENARY TALK

- [1] The approximation capability of the feedforward neural network and a class of generalized fourier network, *The Third National Conference of Chinese SIAM*, Xian, 1994.
- [2] Neural network for solving mathematical programming, *International Conference on Optimization and Numerical Algebra*, Nanjing, September 27-30, 1999.
- [3] A new evaluation and forecasting method: the inverse DEA formulation, *International Workshop on Optimization with High Technology Applications*, Hong Kong, October 23-25, 2000.
- [4] The inverse DEA model: A prediction tool for not-for-profit organizations, *The 34th Workshop on Optimization and Control with Applications*, International School of Mathematics "G.Stampacchia", Erice, Italy, July 9-17, 2001.
- [5] The history and recent development of OR in China, a keynote speech at the *2003 National Meeting of the OR Society of Japan*, Fukuoka, Japan, September, 10, 2003.

RESEARCH PAPERS

Bioinformatics

REFEREED JOURNAL ARTICLES

- [1] Xiangsun Zhang, Jihong Zhang and Lingyun Wu, A reconstruction algorithm to solve positional sequencing by hybridization, *J. of Systems Science and Mathematical Sciences*, vol.22, no.3, pp.258-269, 2002 (in Chinese).
- [2] Ji-Hong Zhang, Ling-Yun Wu and Xiang-Sun Zhang, Reconstruction of DNA sequencing by hybridization, *Bioinformatics*, vol.19, no.1, pp.14-21, 2003.
- [3] Rui-Sheng Wang, Ling-Yun Wu, Ji-Hong Zhang and Xiang-Sun Zhang, Algorithms for the SNP haplotype assembly problem, *Applied Mathematics, A Journal of Chinese Universities (Series A)*, vol.19, pp.515-528, 2004.
- [4] Zhenping Li, Yong Wang, Yuying Zhao and Xiang-Sun Zhang, Haplotype inference and mating graphs, *Applied Mathematics, A Journal of Chinese Universities (Series A)*, vol.19, pp.567-576, 2004.
- [5] Xiang-Sun Zhang, Yong Wang, Zhong-Wei Zhan, Ling-Yun Wu and Luonan Chen, Exploring protein's optimal HP configurations by self-organizing mappings, *J. of Bioinformatics and Computational Biology*, vol.3, no.2, pp.385-400, 2005.
- [6] Ruisheng Wang, Lingyun Wu, Zhenping Li, and Xiangsun Zhang, Haplotype reconstruction from SNP fragments by minimum error correction, *Bioinformatics*, vol.21, no.10, pp.2456-2462, 2005.
- [7] Tianshou Zhou, Luonan Chen, Yun Tang, and Xiangsun Zhang, Aligning multiple protein structures by deterministic annealing, *J. of Bioinformatics and Computational Biology*, vol.3, no.4, pp.837-860, 2005.
- [8] Zhenping Li, Wenfeng Zhou, Xiangsun Zhang, Luonan Chen, A parsimonious tree-grow method for haplotype inference, *Bioinformatics*, vol.21, no.17, pp.3475-3481, 2005.
- [9] Ji-hong Zhang, Ling-yun Wu and Xiang-sun Zhang, A reconstruction algorithm to DNA sequencing by hybridization with target DNA length error, *Acta Mathematicae Applicatae Sinica* vol.28, no.3, pp.385-395, 2005 (in Chinese).
- [10] Yong Wang, Zhongwei Zhan, Lingyun Wu, and Xiangsun Zhang, An improved self-organizing map algorithm for protein folding and its realization, *System Science and Mathematics*, vol.25, no.4, 2005.
- [11] Yuying Zhao, Lingyun Wu, Jihong Zhang, Ruisheng Wang, and Xiangsun Zhang, The SNPs haplotype assembly problem of a single individual, *Computational Biology and Chemistry*, vol.29, pp.281-287, 2005.
- [12] Zhenping Li, Xiang-sun Zhang and Luonan Chen, Unique optimal folding of proteins on a triangular lattice, *Applied Bioinformatics*, vol.4, no.2, pp.105-116, 2005.
- [13] Luonan Chen, Ling-Yun Wu, Ruiqi Wang, Yong Wang, Shihua Zhang, Xiang-Sun Zhang, Comparison of protein structures by multi-objective optimization, *Genome Informatics*, vol.16, no.2, pp.114-124, 2005.
- [14] Xiang-Sun Zhang, Rui-Sheng Wang, Ling-Yun Wu, Luo-Nan Chen, Models and algorithms for the haplotyping problem, *Current Bioinformatics*, vol.1,

- no.1, pp.105-114, 2006
- [15] Yong Wang, Ling-Yun Wu, Xiang-Sun Zhang and Luonan Chen, Exploring the Classification of Protein Structures on Geometric Patterns by Neural Networks, *International Journal of Computational Intelligence Research (IJ-CIR)*, vol.2, no.1, pp.105-109, 2006
 - [16] Yong Wang, Ling-Yun Wu, Luonan Chen and Xiang-Sun Zhang, Supervised classification of protein structures based on convex hull representation, *International Journal of Bioinformatics Research and Applications*, Vol. 3, No. 2, 2006.
 - [17] Shi-hua Zhang, Xiang-Sun Zhang, Visualization of conformational space based on $C\alpha - C\alpha$ distance, *Chinese J. of Bioinformatics* (in Chinese), vol.4, no.4, pp.153-156, 2006
 - [18] Luonan Chen, Ling-Yun Wu, Yong Wang, Xiang-Sun Zhang, Inferring Protein Interactions from Experimental Data by Association Probabilistic Method, *Proteins: Structure, Function, and Bioinformatics*, vol.62, pp.833-837, 2006
 - [19] Shihua Zhang, Rui-Sheng Wang, Xiang-Sun Zhang, Identification of overlapping community structure in complex networks using fuzzy c-means clustering, *Physica A*, 374(1), pp.483-490, 2007
 - [20] Xiang-Sun Zhang, Rui-Sheng Wang, Ling-Yun Wu, Wei Zhang, Minimum conflict individual haplotyping from SNP fragments and related genotype, *Evolutionary Bioinformatics Online*, vol.2, pp.271-280, 2006
 - [21] Luonan Chen, Ling-Yun Wu, Yong Wang, Shihua Zhang, Xiang-Sun Zhang, Revealing divergent evolution, identifying circular permutations and detecting active-sites by protein structure comparison, *BMC: Structural Biology*, 2006, 6:18
 - [22] Shihua Zhang, Xue-Mei Ning, Xiang-Sun Zhang, Identification of functional modules in PPI network by clique percolation clustering, *Computational Biology and Chemistry*, vol.30, pp.445-451, 2006
 - [23] Yong Wang, Trupti Joshi, Xiang-Sun Zhang, Dong Xu, Luonan Chen, Inferring gene regulatory networks from multiple microarray datasets, *Bioinformatics*, vol.22, no.19, pp.2413-2420, 2006
 - [24] Zhen-Ping Li, Ling-Yun Wu, Yu-Ying Zhao and Xiang-Sun Zhang, A dynamic programming algorithm for the k-haplotyping problem, *Acta Mathematicae Applicatae Sinica*, Vol.22, No.3, pp.405-412, 2006.
 - [25] Ji-Hong Zhang, Ling-Yun Wu, Yu-Ying Zhao, Xiang-Sun Zhang, An Optimization Approach to the Reconstruction of Positional DNA Sequencing by Hybridization with Errors, *European J. of Operational research*, 182, pp.413-427, 2007
 - [26] Shihua Zhang, Guangxu Jin, Xiang-Sun Zhang, Luonan Chen, Discovering functions and revealing mechanisms at molecular level from biological networks, *Proteomics*, in press
 - [27] Zhenping Li, Shihua Zhang, Yong Wang, Xiang-Sun Zhang, and Luonan

- Chen, Alignment of molecular networks by integer quadratic programming, *Bioinformatics*, 2007; doi: 10.1093/bioinformatics/btm156
- [28] Shi-Hua Zhang, Xuemei Ning, Xiang-Sun Zhang, Graph kernels, hierarchical clustering, and network community structure: experiments and comparative analysis, *European Physical J, B*, in press
- [29] Rui-Sheng Wang, Ling-Yun Wu, Xiang-Sun Zhang and Luonan Chen. A Markov chain model for haplotype assembly by SNP fragments. *Genome Informatics*, in press
- [30] Yong Wang, Trupti Joshi, Xiang-Sun Zhang, Dong Xu, Luonan Chen, Recovering gene regulation and identifying compound targets from multiple time course expression datasets, submitted to *PLoS Bioinformatics*
- [31] Xiang-Sun Zhang, Rui-Sheng Wang, Ling-Yun Wu, Yong Wang, Shihua Zhang, Luonan Chen, Predicting Protein Interactions Based on Parsimony Tendency of Domain Interactions, in submission

PROCEEDINGS ARTICLES

- [32] Ling-yun Wu, Ji-hong Zhang, and X.-S.Zhang, Neural networks approach to DNA sequencing by hybridization, *Operations Research and Its Applications*, Lecture Notes in Operations Research, vol.4, pp.312-320, World Publishing Corporation, 2002.
- [33] Luo-Nan Chen, Tian-Shou Zhou, Yun Tang and Xiang-Sun Zhang, Structure alignment of protein by mean field annealing, ICSB2003.
- [34] Rui-sheng Wang, Ling-yun Wu, Zhen-ping Li and Xiang-sun Zhang, A genetic algorithm for the individual haplotyping problem, *Proceedings of the Seventh National Conference of Operations Research Society of China*, pp.814-823, Global-Link Publishing Company, Hong Kong, 2004.
- [35] Ji-hong Zhang, Ling-yun Wu, Yong Wang, Zhen-ping Li and Xiang-sun Zhang, A statistical method based on Markov chain for optimal reconstruction of haplotype from genotype data with SNP, *Proceedings of the Seventh National Conference of Operations Research Society of China*, pp.1268-1277, Global-Link Publishing Company, Hong Kong, 2004.
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- [38] Rui-Sheng Wang, Xiang-Sun Zhang, Li Sheng, Haplotype inference by pure

- parsimony via genetic algorithm, *Operations Research and Its Applications*, Lecture Notes in Operations Research, vol.5, pp.308-318, World Publishing Corporation, 2005.
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- [43] Zhenping Li, Yong Wang, Shihua Zhang, Xiang-sun Zhang, Luonan Chen, Alignment of protein interaction networks by integer quadratic programming, *IEEE Engineering in Medicine and Biology Society*, 2006
- [44] Xiang-Sun Zhang, Rui-Sheng Wang, Lin-Yun Wu, Shi-Hua Zhang, Luonan Chen, Inferring Protein-Protein Interactions by Combinatorial Models, *IFMBE Proceedings*, vol.14, pp.181-184, World Conference on Medical Physics and Biomedical Engineering, Seoul, Korea, Springer-Verlag, 2006
- [45] Yong Wang, Lin-Yun Wu, Xiang-Sun Zhang and Luonan Chen, Protein comparisons based on both structure and sequence data, *IFMBE Proceedings*, vol.14, pp.172-175, World Conference on Medical Physics and Biomedical Engineering, Seoul, Korea, Springer-Verlag, 2006
- [46] Jinshan Li, Xiang-Sun Zhang, An Optimization Model for Achieving Sparsity of Gene Regulatory Networks, *Operations Research and Its Applications*, Lecture Notes in Operations Research, vol.6, pp.368-379, World Publishing Corporation, 2006.
- [47] Ji-Hong Zhang, Ling-Yun Wu, Jian Chen and Xiang-Sun Zhang, A new statistical method for haplotype inference from genotype data, *CASB06 Proceedings*, The IASTED International Conference on Computational and Systems Biology, Dallas, Texas, USA, 2006, pp.7-12, ISBN CD: 0-88986-601-5.

Mathematical Programming

REFEREED JOURNAL ARTICLES

- [1] X.-S. Zhang: An improved Rosen-Ploak method, *Acta Mathematicae Applicatae Sinica*, Vol. 2, No. 3, 1979, pp257-267.(in Chinese)
- [2] X.-S. Zhang: Discussion on Polak's algorithm of nonlinear programming, *Acta Mathematicae Applicatae Sinica*, Vol. 4, No. 1, 1981, pp.1-13. (in Chinese)
- [3] X.-S. Zhang: On convergence of gradient projection method of nonlinear constraints problem, *Chinese Journal of Operations Research*, Vol. 1, No. 1, 1982. (in Chinese)
- [4] X.-S. Zhang: A survey of deterministic methods for searching global optimum, *Chinese J. of Operations Research*, Vol. 3, No. 2, 1984, pp. 1-13. (in Chinese)
- [5] X.-S. Zhang: A discussion on the convergence of Rosen's gradient projection method, *Acta Mathematicae Applicatae Sinica*, Vol. 8, No. 1, 1985, pp. 125-128. (in Chinese)
It is collected in *Gradient Projection Method in Linear and Nonlinear Programming*, 327-335, Adv.Discrete Math. Comput. Sci., III, Hadronic Press, Palm Harbor, FL, 1988.
- [6] X.-S. Zhang. J.B. Rosen: Global minimization of concave program, *Mathematics in Economics*, Vol. 1, No. 1, 1985, pp. 121-138. (in Chinese)
- [7] D.-Z. Du, X.-S. Zhang: A convergence theorem of Rosen's gradient projection method, *Mathematical Programming*, 36(1986), No. 2, pp. 135-144.
- [8] D.-Z. Du, X.-S. Zhang, Global convergence of Rosen's gradient projection method, *Chinese J. of Operations Research*, vol.6, no.2, 1987, pp.73-74. (in Chinese)
- [9] X.-S. Zhang: Discussion on the convergence of Rosen's gradient projection method, *Acta Mathematicae Applicatae Sinica (English Series)*, Vol. 3, No. 3, 1987, pp.280-288.
- [10] D.-Z. Du, X.-S. Zhang: Global convergence of Rosen's gradient projection method, *Mathematical Programming*, 44 (1989) No.3. pp.357-366.
- [11] D.-Z. Du and X.-S. Zhang: On a new gradient projection method, *Systems Science and Mathematical Sciences*. Vol. 2, No. 2, 1989, pp. 184-192.
- [12] J.-J. Niu, X.-S. Zhang: Discussion on the possibility of applying the concepts and methods of nonlinear programming to design polynomial algorithm of linear programming, *Journal of Qufu Normal University*, Natural Science Edition, Vol. 15, No. 4, 1989, pp. 8-14. (in Chinese)
- [13] X.-S. Zhang, D.-G. Liu: A note on the continuity of solutions of parametric linear programs, *Mathematical Programming*. 47 (1990), pp. 143-153

- [14] D.-Z. Du, F. Wu, X.-S. Zhang: On Rosen's gradient projection methods, *Annals of Operations Research*, 24(1990), 11-28.
- [15] X.-S. Zhang and D.-Z. Du: Extended binary search and its application in design of polynomial-time algorithm for LP, *Systems Science and Mathematical Sciences*, Vol.10, No.4(1990), pp. 371-376 (in Chinese)
- [16] D.-Z. Du, F. Wu and X.-S. Zhang: Why the objective function is nonlinearized in interior point methods for linear programming? *Mathematics in Practice and Theory*, No.2(1990), 63-68, (in Chinese)
- [17] X.-S. Zhang, J.-C. Cui, and D.-G. Liu: A survey of the development of sensitivity analysis in parametric LP, *Mathematics in Practice and Theory*, No.4, pp.41-48, 1991 (in Chinese).
- [18] X.-S. Zhang, Stability study of linear programming with parameters, *Journal of Qufu Normal University*, Vol.19, No.1, pp.37-43, 1993 (in Chinese).
- [19] X.-S. Zhang, A unified approach for design of LP polynomial algorithms, *Journal of Engineering*, Vol.7, No.3, pp.155-160, 1994.
- [20] Juliang Zhang, and Xiangsun Zhang, A smoothing approximation to the exact penalty function for optimization with inequality constraints, *J. Sys. Sci. & Math. Scis*, vol.20, no.4, pp.499-505, 2000.
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- [22] Ju-Liang Zhang, and Xiang-sun Zhang, A SQP method for equality constrained optimization and its convergence, *Acta Mathematicae Applicatae Sinica*, vol.24, no.1, pp.1-9, 2001 (in Chinese).
- [23] Ju-Liang Zhang and Xiang-sun Zhang, A SQP method based on smoothing penalty function for nonlinear optimization with inequality constraint, *J. of Systems Science and Complexity*, vol.14, no.2 pp.212-217, 2001.
- [24] Ju-Liang Zhang, and Xiang-sun Zhang, A modified SQP method with non-monotone linesearch technique, *Journal of Global Optimization*, vol.21, no.2, pp.201-218, 2001.
- [25] Juliang Zhang, and Xiangsun Zhang, A quasi-Newton—trust region method for equality constrained optimization and its convergence properties, *OR Transactions*, vol5, no.4, pp.72-80, 2001.
- [26] Zhongwen Chen, and Xiangsun Zhang, A trust-region and affine scaling algorithm for linearly constrained optimization, *Science in China (Series A)*, vol.45, no.7, pp.1-9, 2002.
- [27] J.-L. Zhang, and X.-S. Zhang, A robust SQP method based on a smoothing approximate penalty function for inequality constrained optimization, *Journal of Systems Science and Complexity*, vol.15, no.1, pp.102-112, 2002.
- [28] Xiang-sun Zhang, and Ju-liang Zhang, Li-zhi Liao, An adaptive trust region method and its convergence, *Science in China (Series A)*, vol.45, no.5, pp.620-631, 2002.
- [29] J.-L. Zhang and X.-S. Zhang, A SQP method for inequality constrained opti-

- mization, *Acta Mathematicae Applicatae Sinica*, English Series, vol.18, no.1, pp.77-84, 2002.
- [30] J.-L.Zhang, X.-S.Zhang, and X.-J.Zhuo, On the global convergence of a trust region method without regularity conditions, *Mathematica Numerica Sinica*, vol.24, no.4, pp.437-450, 2002 (in Chinese).
- [31] J.-L.Zhang, X.-S.Zhang, A sequential penalty algorithm for nonlinear constrained optimization, *J. of Optimization Theory and Application*, vol.118, no.3, 2003.
- [32] L.-P.Zhang, X.-S.Zhang, Global linear and quadratic one-step smoothing Newton method for $P0$ -LCP, *Journal of Global Optimization*, vol.25, no.4, pp.363-376, 2003.
- [33] J.-L.Zhang, X.-S.Zhang, Z.W.Chen, On the convergence of a trust region method for general constrained optimization without regular condition, *Acta Mathematicae Applicatae Sinica*, vol.26, no.1, pp.1-10, 2003.
- [34] J.-L.Zhang, X.-S.Zhang, X.J.Zhuo, A robust SQP method for optimization with inequality constraints, *J. of Computational Mathematics*, vol.21, no.2, pp.247-256, 2003.
- [35] J.-L.Zhang, X.-S.Zhang, A nonmonotone adaptive trust region method and its convergence, *Computers and Mathematics with Applications*, vol.45, pp.1469-1477, 2003.
- [36] J.-L.Zhang, X.-S.Zhang, A predictor-corrector method for convex quadratic programming, *Journal of Systems Science and Mathematical Sciences*, vol.23, no.3, pp.366-372, 2003. (in Chinese)
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method without assumption of positive-definite Hessian, *J. of Optimization Theory and Application*, vol.129, no.1, pp.201-218, 2006.

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PROCEEDINGS ARTICLES

- [45] Sheng Li and Xiang-Sun Zhang, Some useful numerical examples in discussion on continuity of solutions of parametric linear programming, *Proceedings of APORS'91*, Peking University Press, Beijing, 1992, pp. 501-508.
- [46] Xiang-Sun Zhang and Ju-Liang Zhang, A quasi-Newton-trust region method for equality constrained optimization and its convergence properties, *Proceedings of the Sixth National Conference of Operations Research Society of China*, pp.998-1005, Global-Link Publishing Company, Hong Kong, 2000.
- [47] Zhen-Jun Shi, Xiang-Sun Zhang, Convergence analysis of adaptive trust region methods, Preprint on Report of Research, IAM-R002, 2005.
- [48] Zhen-Jun Shi, Xiang-Sun Zhang, From line search method to trust region method, *Operations Research and Its Applications*, Lecture Notes in Operations Research, vol.5, pp.156-170, World Publishing Corporation, 2005.
- [49] Hong-wei Liu, Minjie Wang, and Xiang-sun Zhang, The global convergence of non-quasi Newton methods with non-monotone linear search, *Proceedings of the Eighth National Conference of Operations Research Society of China*, pp.70-75, Global-Link Publishing Company, Hong Kong, 2004 (in Chinese).

Artificial Neural Network

REFEREED JOURNAL ARTICLES

- [1] Xiang-Sun ZHANG, Hong-Feng LI, Xiao-Dong WANG, A straightforward mathematical analysis for the Hopfield neural network, *Acta Electronica Sinica*, Vol. 20, pp. 10-18, 1992.
- [2] X.-S.Zhang, Mathematical analysis for some neural networks that solving linear and quadratic programming, *Acta Mathematicae Applicatae Sinica*, Vol.12, No.1, pp.1-10, 1996.
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- coloring map problems”, *OR Transactions*, vol.3, no.3, pp.35-43, 1999 (in Chinese).
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- [6] De-gang Liu, Xiang-sun Zhang, Test problem generator by neural network for algorithms that try solving nonlinear programming problems globally, *Journal of Global Optimization*, vol.16, no.3, pp.229-243, 2000.
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