

## **Lu Ruan, Ph. D.**

Associate Professor  
Department of Engineering and Computer Science  
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### **EDUCATION**

**Ph.D.** in Computer Science, University of Minnesota-Twin Cities.

**M.S.** in Computer Science, University of Minnesota-Twin Cities.

**B.E.** in Computer Science & Technology, Tsinghua University, China.

### **EMPLOYMENT**

2020 – Present	<b>Associate Professor</b> Department of Engineering and Computer Science, Azusa Pacific University, Azusa, CA.
2009 – 2020	<b>Associate Professor</b> Department of Computer Science, Iowa State University, Ames, IA.
2001 – 2009	<b>Assistant Professor</b> Department of Computer Science, Iowa State University, Ames, IA.
1996 – 1997	<b>Software Design Engineer</b> Beijing EPSON Electronics Corporation, Beijing, China.

### **RESEARCH INTERESTS**

Internet topology, Internet routing, content delivery networks.

### **HONORS AND AWARDS**

2006	Best Paper Award finalist, 15 <sup>th</sup> International Conference on Computer Communications and Networks.
2003	CAREER Award, National Science Foundation.
2001	Graduate Fellowship, University of Minnesota-Twin Cities.
1993	Excellent Student Scholarship, Tsinghua University, China.
1992	Zhong Shimo Scholarship, Tsinghua University, China.

### **PROFESSIONAL SOCIETIES**

Institute of Electrical and Electronics Engineers (IEEE), Senior Member.

### **TEACHING**

#### **Courses Taught at Iowa State University (2001-2020)**

- Com S 228 Introduction to Data Structures
- Com S 330 Discrete Computational Structures

- Com S 352 Introduction to Operating Systems
- Com S 454/554 Distributed Systems
- Com S 486 Fundamental Concepts in Computer Networking
- Com S 586 Computer Network Architectures
- Com S 652 Advanced Topics in Distributed Operating Systems
- Com S 686 Advanced Topics in High-Speed Networks

## GRADUATE STUDENTS SUPERVISED

1. Jinu Susan Kabala, Ph.D. in CS, 2020
2. Xingji Chen, M.S. in CS, 2019.
3. Liangyu Tan, M.S. in CS, 2019.
4. He Jin, M.S. in CS, 2018.
5. Abhilash Kolluri, M.S. in CS, 2018.
6. Lizhi Xiang, M.S. in CS, 2018.
7. Gaurav Bhatt, M.S. in CS, 2017.
8. Karthiapil Nikhil Chakeeri, M.S. in CS, 2017.
9. Dhaval Shah, M.S. in CS, 2017.
10. Shanmukha Pericharla, M.S. in CS, 2016.
11. Srikanth Nadella, M.S. in CS, 2016.
12. Rajesh Putta Venkata, M.S. in CS, 2016 (Co-Major Professor: Ahmed Kamal).
13. Krishna Chaitanya Yalamanchili, M.S. in CS, 2015.
14. Yanwei Zheng, M.S. in CS, 2013.
15. Nan Xiao, M.S. in CS, 2012.
16. Sai Kiran Talamudupula, M.S. in CS, 2011 (Co-Major Professor: Masha Sosonkina)
17. Taiming Feng, PhD in CS, 2010 (Co-Major Professor: Wensheng Zhang)
18. Bharat Kumar Addagada, M.S. in CS, 2010 (Co-Major Professor: Johnny Wong)
19. Vineeth Kisara, M.S. in CS, 2010.
20. Sangil Choi, M.S. in CS, 2009.
21. Ronnie Koshy, M.S. in CS, 2009.
22. Varun Srinivas, M.S. in CS, 2009.
23. Aditya Dhananjay, M.S. in CS, 2008.
24. Chang Liu, Ph.D. in CS, 2007.
25. Zhi Liu, M.S. in CS, 2005.
26. Fangcheng Tang, M.S. in CS, 2005.
27. Haibo Luo, M.S. in CS, 2003.

## PUBLICATIONS

### Books

1. **L. Ruan** and D-Z. Du (Editors). *Optical Networks-Recent Advances*. Kluwer Academic Publishers, 2001.

### Journal Articles

2. **L. Ruan** and Y. Zheng, Dynamic Survivable Multipath Routing and Spectrum Allocation in OFDM-Based Flexible Optical Networks, *Journal of Optical Communications and Networking*, 6(1):77-85, January 2014.

3. **L. Ruan** and N. Xiao, Survivable Multipath Routing and Spectrum Allocation in OFDM-Based Flexible Optical Networks, *Journal of Optical Communications and Networking*, 5(3):172-182, March 2013 (**The most downloaded paper for the journal in March 2013.**)
4. **L. Ruan** and N. Xiao, An Efficient Scheme for Two-Link Failure Protection/Restoration in WDM Mesh Networks, *Journal of High Speed Networks*, 18(3):185-195, October 2012.
5. T. Feng and **L. Ruan**. Design of Survivable Hybrid Wireless-Optical Broadband-Access Network. *Journal of Optical Communications and Networking*, 3(5): 458-464, May 2011.
6. T. Feng, L. Long, A. E. Kamal, and **L. Ruan**. Two-Link Failure Protection in WDM Mesh Networks with p-Cycles. *Elsevier Computer Networks*, 54(17):3068-3080, December 2010.
7. T. Feng, **L. Ruan**, and W. Zhang. Intelligent p-Cycle Protection for Dynamic Multicast Sessions in WDM Networks. *Journal of Optical Communications and Networking*, 2(7): 389-399, July 2010.
8. M. X. Cheng, **L. Ruan**, and W. Wu. Coverage Breach Problems in Bandwidth Constrained Sensor Networks. *ACM Transactions on Sensor Networks*, 3(2): Article 12, June 2007.
9. C. Liu and **L. Ruan**. A New Survivable Mapping Problem in IP-over-WDM Networks. *IEEE Journal on Selected Areas in Communications*, 25(4):25-34, April 2007.
10. **L. Ruan**, F. Tang, and C. Liu. Dynamic Establishment of Restorable Connections Using p-Cycle Protection in WDM Networks. *Optical Switching and Networking*, 3(3+4):191-201, 2006.
11. **L. Ruan** and F. Tang. Survivable IP Network Realization in IP-over-WDM Networks under Overlay Model. *Computer Communications*, 29(10):1772-1779, June 2006.
12. C. Liu and **L. Ruan**. P-Cycle Design in Survivable WDM Networks with Shared Risk Link Groups (SRLGs). *Photonic Network Communications*, 11(3):301-311, May 2006.
13. **L. Ruan** and W. Wu. Broadcast Routing with Minimum Wavelength Conversion in WDM Optical Networks. *Journal of Combinatorial Optimization*, 9(2):223-235, March 2005.
14. **L. Ruan**, S. Han, D. Li, Hung Q. Ngo, and S. Huang. Transmission Fault-Tolerance of Iterated Line Digraphs. *Journal of Interconnection Networks*, 5(4):475-487, December 2004.
15. **L. Ruan**, H. Du, X. Jia, W. Wu, Y. Li, and K. Ko. A Greedy Approximation for Minimum Connected Dominating Sets. *Theoretical Computer Science*, 329(1-3):325-330, December 2004.
16. **L. Ruan**, H. Luo, and C. Liu. A Dynamic Routing Algorithm with Load Balancing Heuristics for Restorable Connections in WDM Networks. *IEEE Journal on Selected Areas in Communications*, 22(9):1823-1829, November 2004.
17. X. Cheng, X. Du, M. Min, H. Q. Ngo, **L. Ruan**, J. Sun, and W. Wu. Super Link-Connectivity of Iterated Line Digraphs. *Theoretical Computer Science*, 304(1-3):461-469, July 2003.
18. X. Jia, X. Hu, **L. Ruan**, and J. Sun. Multicast Routing, Load Balancing and Wavelength Assignment on Tree of Rings. *IEEE Communications Letters*, 6(2):79-81, February 2002.
19. **L. Ruan**, D-Z. Du, X. Hu, X. Jia, D. Li, and Z. Sun. Converter Placement Supporting Broadcast in WDM Optical Networks. *IEEE Transactions on Computers*, 50(7):750-758, July 2001.
20. B. Lu and **L. Ruan**. Polynomial Time Approximation Scheme for the Rectilinear Steiner Arborescence Problem. *Journal of Combinatorial Optimization*, 4(3):357-363, September 2000.
21. D. Li, X. Du, X. Hu, **L. Ruan**, and X. Jia. Minimizing Number of Wavelengths in Multicast Routing Trees in WDM Networks. *Networks*, 35(4):260-265, July 2000.

## Refereed Conference and Workshop Papers

22. J. Susan Varghese and **L. Ruan**, Computing Customer Cones of Peering Networks, *Applied Networking Research Workshop 2016 (ANRW'16)*, Berlin, Germany, July 2016.
23. J. Susan Varghese and **L. Ruan**, A Machine Learning Approach to Edge Type Inference in Internet AS Graphs, *8<sup>th</sup> IEEE International Workshop on Network Science for Communication Networks (NetSciCom'16)*, San Francisco, CA, April 2016.

24. N. Xiao and **L. Ruan**. Survivable Multipath Provisioning in OFDM-Based Flexible Optical Networks, in *IEEE Globecom Workshop on Flexible Optical Networks*, pages 346-351, Anaheim, CA, December, 2012.
25. **L. Ruan** and T. Feng. A Hybrid Protection/Restoration Scheme for Two-Link Failure in WDM Mesh Networks, in *Proc. of Globecom 2010*, Miami, FL, December, 2010.
26. T. Feng and **L. Ruan**. p-Cycle-based Path Protection for Multicast Sessions in WDM Networks, in *Proc. of Chinacom 2010*, Beijing, China, August 2010.
27. T. Feng, **L. Ruan**, C. Wang, and H. Qin. PXT-based Path Protection for Multicast Sessions in WDM Networks, in *Proc. of 33<sup>rd</sup> IEEE Sarnoff Symposium*, Princeton, NJ, April 2010.
28. R. Koshy and **L. Ruan**. A Joint Radio and Channel Assignment (JRCA) Scheme for 802.11-based Wireless Mesh Networks, in *5th IEEE Broadband Wireless Access Workshop*, Honolulu, Hawaii, December 2009.
29. V. Srinivas and **L. Ruan**. An Efficient Reliable Multicast Protocol for 802.11-based Wireless LANs, in *Proc. of 10<sup>th</sup> IEEE International Symposium on a World of Wireless, Mobile and Multimedia Networks (WoWMoM)*, Kos Greece, June 2009.
30. T. Feng and **L. Ruan**, A Multi-layer Adaptive Protection Scheme for IP-over-WDM networks, in *Proc. of 4<sup>th</sup> International Conference on Communications and Networking in China (CHINACOM)*, Xi'an China, Aug 2009.
31. T. Feng and **L. Ruan**. Design of Survivable Hybrid Wireless-Optical Broadband-Access Network, in *Proc. of the IEEE International Conference on Communications 2009 (ICC'09)*, Dresden, Germany, June 2009.
32. A. Dhananjay and **L. Ruan**. PigWin: Meaningful Load Estimation in IEEE 802.11 Based Wireless LANs. In *Proc. of the IEEE International Conference on Communications 2008 (ICC'08)*, pages 2541-2546, Beijing, China, May 2008.
33. T. Feng, **L. Ruan**, W. Zhang. Intelligent p-Cycle Protection for Multicast Sessions in WDM Networks. In *Proc. of the IEEE International Conference on Communications 2008 (ICC'08)*, pages 5165-5169, Beijing, China, May 2008.
34. T. Feng, C. Wang, W. Zhang, and **L. Ruan**. Confidentiality Protection Schemes for Data Aggregation in Sensor Networks. In *Proc. of the 27<sup>th</sup> IEEE Conference on Computer Communications (INFOCOM'08)*, pages 475-483, Phoenix, AZ, April 2008.
35. **L. Ruan** and Z. Liu. A Capacity Efficient Local Protection Scheme for Bandwidth Guaranteed Connections. In *Proc. of the IEEE International Conference on Communications 2007 (ICC'07)*, pages 6368-6373, Glasgow, Scotland, June 2007.
36. C. Liu and **L. Ruan**. Dynamic Provisioning of Survivable Services Using Path-Segment Protecting p-Cycles in WDM Networks. In *Proc. of 15<sup>th</sup> Int'l Conf. on Computer Communications and Networks (ICCCN'06)*, pages 275-280, Arlington, VA, October 2006 (**Best paper finalist**).
37. C. Liu and **L. Ruan**. Logical Topology Augmentation for Survivable Mapping in IP-over-WDM Networks. In *Proc. of IEEE Global Communications Conference 2005 (Globecom'05)*, volume 4, pages 1885-1889, St. Louis, MO, November/December 2005.
38. **L. Ruan** and Chang Liu. A Heuristic Algorithm for Survivable Mapping in IP-over-WDM Networks. In *Proc. of 3<sup>rd</sup> IASTED Int'l Conf. on Communications and Computer Networks*, pages 164-170, Marina del Rey, CA, October 2005.
39. Z. Liu and **L. Ruan**. Reducing Restoration Blocking in WDM Optical Networks. In *Proc. of 14<sup>th</sup> Int'l Conf. on Computer Communications and Networks (ICCCN'05)*, pages 323-330, San Diego, CA, October 2005.
40. C. Liu and **L. Ruan**. p-Cycle Design in Survivable Networks with Shared Risk Link Groups (SRLGs). In *Proc. of 5<sup>th</sup> Int'l Workshop on Design of Reliable Communication Networks (DRCN'05)*, pages 207-212, Island of Ischia, Italy, October 2005.
41. **L. Ruan** and F. Tang. Dynamic Establishment of Restorable Connections using p-Cycle Protection in WDM Networks. In *Proc. of 2<sup>nd</sup> Int'l Conf. on Broadband Networks (Broadnets'05)*, pages 147-154, Boston, MA, October 2005.

42. F. Tang and **L. Ruan**. A Protection Tree Scheme for First-Failure Protection and Second-Failure Restoration in Optical Networks. In *Proc. of 3<sup>rd</sup> Int'l Conf. on Computer Networks and Mobile Computing (Lecture Notes in Computer Science 3619)*, pages 620-631, Zhangjiajie, China, August 2005.
43. **L. Ruan** and Z. Liu. Upstream Node Initiated Fast Restoration in MPLS Networks. In *Proc. of the IEEE International Conference on Communications 2005 (ICC'05)*, pages 959-964, Seoul, Korea, May 2005.
44. M. X. Cheng, **L. Ruan**, and W. Wu. Achieving Minimum Coverage Breach under Bandwidth Constraints in Wireless Sensor Networks. In *Proc. of the 24<sup>th</sup> IEEE Conference on Computer Communications (INFOCOM'05)*, pages 2638-2645, Miami, FL, March 2005.
45. C. Liu and **L. Ruan**. Finding Good Candidate Cycles for Efficient p-Cycle Network Design. In *Proc. of 13<sup>th</sup> Int'l Conf. on Computer Communications and Networks (ICCCN'04)*, pages 321-326, Chicago, IL, October 2004.
46. **L. Ruan** and H. Luo. Dynamic Routing of Restorable Lightpaths: A Tradeoff Between Capacity Efficiency and Resource Information Requirement. In *Proc. of the 7<sup>th</sup> IFIP Working Conference on Optical Network Design and Modeling (ONDM'03)*, pages 537-548, Budapest, Hungary, February 2003.
47. H. Luo and **L. Ruan**. Load Balancing Heuristics for Dynamic Establishment of Restorable Lightpaths. In *Proc. of 11<sup>th</sup> Int'l Conf. on Computer Communications and Networks (ICCCN'02)*, pages 472-477, Miami, FL, October 2002.
48. **L. Ruan** and H. Luo. A Fast Lightpath Restoration Method Using Two Backup Paths in WDM Networks. In *Proc. of 2002 Int'l Conf. on Parallel Processing Workshops*, pages 183-189, Vancouver, Canada, August 2002.
49. X. Jia, X. Hu, **L. Ruan**, and J. Sun. Multicast Routing, Load Balancing and Wavelength Assignment on Tree of Rings. In *Proc of 2001 IASTED Int'l Conf. on Wireless and Optical Communications*, pages 239-244, Banff, Canada, June 2001.
50. **L. Ruan**, D-Z. Du, X. Hu, X. Jia, and D. Li. Approximations for Color-Covering Problems. In *Proc of 1st Int'l Congress of Chinese Mathematicians*, pages 503-507, Beijing, China, December 1998.

## Technical Reports

1. J. Kabala and **L. Ruan**, On Efficiency of AS Paths from Users to Content Servers: A Case Study of Netflix, *Iowa State University Computer Science Technical Reports*, Paper 386, November 2018.
2. R. Putta Venkata and **L. Ruan**. A Region-Centric Analysis of the Internet Peering Ecosystem. *Iowa State University Computer Science Technical Reports*. Paper 381, June 2016.
3. J. Susan Varghese and **L. Ruan**. A Machine Learning Approach to Edge Type Prediction in Internet AS Graphs. *Iowa State University Computer Science Technical Reports*, Paper 375, July 2015.
4. **L. Ruan** and J. Susan Varghese. Computing Observed Autonomous System Relationships in the Internet. *Iowa State University Computer Science Technical Reports*, Paper 367, November 2014.

## GRANTS

- |           |                                                                                                                               |
|-----------|-------------------------------------------------------------------------------------------------------------------------------|
| 2003-2008 | CAREER: Resilience Schemes for Survivable IP over WDM Networks, National Science Foundation, CNS-0237592, \$447,403, sole PI. |
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## **PROFESSIONAL SERVICE**

### **Proposal Review Panel**

2003 National Science Foundation.

### **Conference Organization**

2012 Vice Chair, Computer Networks and Future Internet Symposium, the 4<sup>th</sup> International Conference on Communications, Mobility, and Computing (CMC).

2010 Track Co-Chair, Optical and Backbone Networks Track, the 19<sup>th</sup> IEEE International Conference on Computer Communications and Networks (ICCCN).

2011 Financial Chair, the 10<sup>th</sup> International Symposium on Applications and the Internet (SAINT).

2010 Financial Chair, the 9<sup>th</sup> International Symposium on Applications and the Internet (SAINT).

### **Conference Program Committees**

- IEEE Global Communications Conference (Globecom) 2007, 2010, 2012-2013
- IEEE International Conference on Communications (ICC) 2003, 2008, 2010
- International Conference on Computer Communications and Networks (ICCCN) 2004-2005, 2007-2009
- International Conference on Combinatorial Optimization and Application (COCOA) 2009
- IEEE International Conference on Advanced Networks and Telecommunication Systems (ANTS) 2008
- International Conference on Communications and Networking in China (CHINACOM) 2006-2007
- International Conference on Broadband Communications, Networks, and Systems (Broadnets) 2004-2006
- Optical Networking and Communications Conference (OptiComm) 2001, 2003

### **Referee for Journals**

- IEEE/ACM Transactions on Networking
- Journal of Optical Communications and Networking
- IEEE Journal on Selected Areas in Communications
- Computer Networks
- International Journal of Sensor Networks
- IEEE Communications Magazine
- IEEE Computer
- Journal of Wireless Communications and Mobile Computing
- Theoretical Computer Science
- ACM Baltzer Wireless Networks Journal
- IEEE Communications Letters
- OSA Journal of Optical Networking

## UNIVERSITY, COLLEGE, AND DEPARTMENTAL COMMITTEES

### **Iowa State University**

Member, Promotion and Tenure Committee, Computer Science Department.  
Member, Broadening Participation in Computing Committee, Computer Science Department.  
Chair, Diversity Committee, Computer Science Department.  
Member, Equipment Committee, Computer Science Department.  
Member, Outreach Committee, Computer Science Department.  
Member, Post Tenure Review Advisory Panel, Computer Science Department.  
Member, Graduate Admissions Committee, Computer Science Department.  
Chair, Search Committee for Teaching Intensive Assistance Professor, Computer Science Department.  
Chair, Colloquium Committee, Computer Science Department.  
Member, Graduate Committee, Computer Science Department.  
Member, Scholarship/Awards Committee, Computer Science Department.  
Member, Faculty Search Committee, Computer Science Department.  
Upsilon Pi Epsilon (UPE) Advisor, Computer Science Department.  
Member, Grievance Committee, Computer Science Department.  
Member, College of Liberal Arts and Sciences Computer Advisory Committee.