

## **Cheng Hsu, Ph.D.**

### **Employment:**

1982 – 1988: Assistant Professor of Information Systems, School of Management, Rensselaer Polytechnic Institute, Troy, NY 12180

1989 - 1996: Associate Professor of Decision Sciences and Engineering Systems, Schools of Management and Engineering, Rensselaer Polytechnic Institute, Troy, NY 12180

1997 – present: Professor of Industrial and Systems Engineering (formerly Decision Sciences and Engineering Systems) and Professor of Information Technology, School of Engineering, Rensselaer Polytechnic Institute, Troy, NY 12180

### **Education:**

1973 B.S. in Industrial Engineering, Tunghai University, Taichung, Taiwan.

1979 M.S. in Industrial and Systems Engineering, Ohio State University, Columbus, Ohio.

1983 Ph.D. in Management Sciences, Ohio State University, Columbus, Ohio 43210.

### **Administration Activities:**

1989 - 1993: Director, Undergraduate Program, Decision Sciences and Engineering Systems Department, Schools of Management, Engineering and Science

1995 - 2001: Director, Doctoral Program, Decision Sciences and Engineering Systems Department, School of Engineering

2000 – 2008: The Institute-wide MS-IT Program Supervisory Committee

2011: Chair, the Task Force on Campus-Wide MS Degree in Cyber-Security

### **Institute Services:**

1983 – 1986 Faculty Council Library Advisory Committee (appointed)

1989 – 1992 Faculty Council Planning and Budget Committee (appointed)

1996 – 1999 Faculty Senate Planning and Resources Committee (appointed)

1998 – 2000 President's Campus Planning Committee (appointed)

2005 – 2006 Senator, Faculty Senate (elected, representing Engineering)

2008 – present: School of Engineering Honors Committee (appointed)

### **Institute Curriculum Development:**

#### *Undergraduate:*

1997: The Committee for the New Institute-wide Degree of BS in Information Technology

1998 – 2002: The Faculty Committee of the BS-IT Program

#### *Graduate:*

1999: The Committee for the New Institute-wide Degree of MS in Information Technology

### **Courses Taught/Undergraduate**

92.451 Management Information Systems I

92.452 Management Information Systems II

83.496 Advanced Management Information Systems

ISYE/DSES 453 Information Systems

ISYE 4290 Discrete Event Simulation Modeling and Analysis  
ISYE/DSES 4270 IME Senior Design (participating in the Multi-Disciplinary Design Lab)

**Courses Taught/Graduate and Distance Learning**

92.650 Information and Decision Systems  
92.696 Information Technology and Systems  
83.650 Management Information Systems  
83.631 Applied Operations Research I  
83.622 Operational Programming  
80.614/92.651 Information Systems for Management  
80.696 Advanced Information Systems  
DSES 652 Enterprise Database Systems (**including on-campus and distance learning**)  
DSES 656 Information Management in Manufacturing Systems  
DSES.657 Information Technology and Systems for e-Business (**including on-campus and distance learning**)  
DSES 690 Doctoral Seminar in DSES  
DSES 691 Advanced Doctoral Seminar in DSES  
ISYE 6620 Discrete Event Simulation (cross-listed with ISYE 4290)

**Student Thesis Supervision (completed)**

Bachelors: 2

Masters: 21

Doctoral: 15 (placement: serving on the faculties at Rensselaer Polytechnic Institute, U. New Mexico, Georgia State, Clarkson, HEC Montreal, Chang-Yung University of Taiwan, the Chinese University of Hong Kong, and King Mongkut Institute of Technology at Ladkrabung of Thailand; and on the staff with GE Global Research, Oracle, Samsung, and several other companies)

On-going doctoral students: 1

**Research Interests:**

*General:* Information and Knowledge-based Systems; Design Theory for Service Science; the Hyper-Network model for human networking; Sustainability Design; Cyber-Infrastructure Innovation; Enterprise Engineering; Computer-Integrated Manufacturing Informatics; and Intelligent Transportation Systems and Logistics.

*Current Topics:* Rebirth Analysis for sustainable products; Cyber-Security analysis and monitoring; human value networks in e-Commerce and new digital services; smart micro grid systems for distributed home-based energy supply; and Metadata Methods for Knowledge Representation and Natural Language Query.

*The Originator* of the Metadatabase Model for large scale information integration, and the Two-Stage Entity-Relationship Model for data and knowledge representation. Both results have been disseminated over the Internet and practiced in select industries. They are being currently

applied to the research of sustainable information systems, concurrent virtual configurations of cyber-infrastructure, and scaling of digital service systems.

**Patent: US 7177798 B2** Natural Language Interface Using Constrained Intermediate Dictionary of Results

**Select Publications** (total over 120):

**Books:**

C. Hsu., *Enterprise Integration and Modeling: the Metadatabase Approach*, Kluwer Academic Publishers, Boston, 1996.

C. Hsu and S. Pant, *Planning for Electronic Commerce and Enterprises: A Reference Model*, Kluwer Academic Publishers, Boston, 2000.

C. Hsu (ed.), *Special Issue on Electronic Commerce, IEEE Transactions on Systems, Man, and Cybernetics, Part A*, Vol. 30, No. 4, July 2000.

D. Levermore and C. Hsu, *Enterprise Collaboration: On-Demand Information Exchange for Extended Enterprises*, Springer Science Publishers, 2006.

C. Hsu (ed.), *Service Enterprise Integration: an Enterprise Engineering Perspective*, Springer Science Publishers, 2007.

C. Hsu, *Service Science: Design for Scaling and Transformation*, World Scientific and Imperial College Press, Singapore, 2009.

C. Hsu, *Information Systems: the Connection of People and Resources for Innovation – a textbook*, World Scientific and Imperial College Press, Singapore, 2012.

**Book Chapters:** several in the areas of Model-base for Adaptive Optimization, Decision Support and Expert Systems, Information Theory, Manufacturing Systems Engineering, and Service Enterprise Engineering.

**Selected Papers Published in Refereed Journals:**

C. Hsu and W.E. Wilhelm, "Flowshop Scheduling with Probabilistic Processing Times," *Production Cost and Engineering Economics*, Vol. 7, 1983, pp. 137-145.

C. Hsu and C. Tuan, "An Information Theoretic Approach to the Determination of Organization Structure: A Framework," *Business Management Review*, Vol. 1, No. 3, 1983, pp. 129-151.

W. L. Gorr and C. Hsu, "An Adaptive Filtering Procedure for Estimating Regression Quantiles," *Management Science*, Vol. 31, No. 8, August 1985, pp. 1019-1029.

C. Hsu, "A Decision Support System for Database Evolution Using Model Independent

Architecture," *Computers and Operations Research*, Vol. 13, No. 4, August 1986, pp. 427-436.

C. Hsu and P. De, "Adaptive Information Systems Control: A Reliability-Based Approach," *Journal of Management Information Systems*, Vol. 3, No. 2, August 1986, pp. 33-51.

A. Charnes, W. W. Cooper, W. L. Gorr, C. Hsu, B. von Rabenau, "Emergency Government Interventions: Case Study of Natural Gas Shortages," *Management Science*, vol. 32, no. 10, 1986, pp. 1242-1258.

C. Hsu and C. Skevington, "Integration of Data and Knowledge management in Computerized Manufacturing Systems," *Journal of Manufacturing Systems*, vol. 6, no. 4, 1987, pp. 277-285.

C. Hsu and C. Skevington, "Manufacturing Architecture for Integrated Systems," *Robotics and Computer-Integrated Manufacturing*, Vol. 4, No. 3/4, 1988, pp. 619-623.

C. Hsu and L. Rattner, "Information Modeling for Computerized Manufacturing," *IEEE Transactions on Systems, Man, and Cybernetics*, vol. 20, no. 4, 1990, pp 758-776.

C. Hsu, M. Bouziane, L. Rattner and L. Yee, "Information Resources Management in Heterogeneous Distributed Environments: A Metadatabase Approach," *IEEE Transactions on Software Engineering*, vol. 17, no. 6, 1991, pp 604-625.

C. Hsu, G. Babin, M. Bouziane, W. Cheung, L. Rattner, and L. Yee, "Metadatabase Modeling for Enterprise Information Integration," *Journal of Systems Integration*, Vol. 2, No. 1, 1992, pp. 5-37.

L. Rattner and C. Hsu, "Integration in Manufacturing: An Information Theoretic Perspective," *Journal of Production and Operations Management*, Vol. 1, No. 3, Summer 1992, pp. 286-294.

C. Hsu and L. Rattner, "Metadatabase Solutions to Enterprise Integration Problems," *ACM Database*, Winter 1993, pp. 23-35.

C. Hsu, Y. Tao, M. Bouziane, and G. Babin, "Paradigm Translations in Integrating Manufacturing Information Using a Meta-Model," *Journal of Information Systems Engineering*, vol. 1, September 1993, pp 325-352.

M. Bouziane and C. Hsu, "A Rulebase Model for Data Knowledge Integration in Multiple Systems Environments," *International Journal of Artificial Intelligence Tools*, Vol. 2, No. 4, December 1993, pp. 485-509 (with M'hamed Bouziane).

C. Hsu and W.A. Wallace, "Model Representation in Information Resources Management," in

- C. Hsu and W.A. Wallace, "Model Representation in Information Resources Management," in Yuji Ijiri, ed., *Creative and Innovative Approaches to the Science of Management*, Quorum Books, Westport, Connecticut, 1993.
- C. Hsu, L. Gerhardt, D. Spooner, and A. Rubenstein, "Adaptive Integrated Manufacturing Enterprises: Information Technology for the Next Decade," *IEEE Transactions on Systems Man, and Cybernetics*, Vol. 24, No. 5, 1994, pp. 828-837.
- C. Hsu, "The Metadatabase Approach to Integrating and Managing Manufacturing Information Systems," *Journal of Intelligent Manufacturing*, Vol. 5, 1994, pp. 333-349.
- O. Schaefer and C. Hsu, "Distributed Rulebases for Real Time Process Control on the Shop Floor: the Metadatabase Approach," *ASME MH-Vol. 2, the 75th Anniversary Commemorative Volume on Materials Handling Engineering*, 1994, pp. 49-59.
- L. Rattner, S. Pant, and C. Hsu, "Manufacturing Information Integration Using a Reference Model," *International Journal of Operations and Production Management*, Vol. 14, No. 11, 1994, pp. 52-72.
- C. Hsu, J. Cho, L. Yee, and L. Rattner, "Core Information Model: A Practical Solution to Costly Integration Problems," *Computer and Industrial Engineering*, Vol. 28, No. 3, 1995, pp. 523-544.
- W. Cheung and C. Hsu, "The Model-Assisted Global Query System for Multiple databases in Distributed Enterprises," *ACM Transactions on Information Systems*, vol. 14, no. 4, 1996, pp 421-470.
- G. Babin and C. Hsu, "Decomposition of Knowledge for Concurrent Processing," *IEEE Transactions on Knowledge and Data Engineering*, vol. 8, no. 5, 1996, pp 758-772.
- C. Hsu and S. Pant, "Business on the Web: Strategies and Economics," *Computer Networks and ISDN Systems*, Vol. 28, 1996, pp. 1481-1492.
- M. Bouziane and C. Hsu, "A Rulebase Management System Using Conceptual Modeling," *International Journal of Artificial Intelligence Tools*, Vol. 6, No. 1, March 1997, pp. 37-61.
- L. Yee and C. Hsu, "A Virtual Reality Interface to an Enterprise Metadatabase," *Lecture Notes in Computer Science*, Volume 1331, 1997, pp. 436 – 449.
- S. Pant and C. Hsu, "Strategic Information Systems Planning," *Journal of Information Resources Management*, Vol. 12, No. 1, December 1998, pp. 15-25.
- L. Yee and C. Hsu, "A Metadata Visualization User Interface for Enterprise Information Management," *International Journal of Computers and Applications*, IASTED, Vol. 21, No. 2, 1999, pp. 36-43.

- C. Hsu, "Editorial to the Special Issue on Electronic Commerce," *IEEE Transactions on Systems, Man, and Cybernetics, Part A*, Vol. 30, No. 4, July 2000, pp. 393-394.
- S. Pant, H-T Sim, and C. Hsu, "A Framework For Developing Web Information Systems Plans: Illustration with Samsung Heavy Industries Co., Ltd.," *Information and Management*, Vol. 38, No. 6, 2001, pp. 385-408.
- J-H Cho and C. Hsu, "A Tool for Minimizing Update Errors for Workflow Applications: the CARD Model," *Computers and Industrial Engineering*, vol. 49, pp. 199-220, 2005.
- M. Dausch and C. Hsu, "Engineering Service Products: The Case of Mass-Customizing Service Agreements for Heavy Equipment Industry", *International Journal of Service Technology and Management*, Vol. 7, No. 1, 2006, pp. 32 - 51.
- C. Hsu, C. Carothers, and D. Levermore, "A Market Mechanism for Participatory Database Query: A First Step of Enterprise Resources Self-Allocation", *Information Technology and Management*, Vol. 7, No. 2, 2006, pp. 71-89.
- V. Boonjing and C. Hsu, "A Feasible Approach to Natural Language Database Query," *International Journal of Artificial Intelligence Tools*, Vol. 15, No. 2, 2006, pp 323-330.
- C. Hsu, D. Levermore, C. Carothers, and G. Babin, "Enterprises Collaboration: On Demand Information Exchange Using Enterprise Databases, Sensor Networks, and RFID Chips," *IEEE Transactions on Systems, Man, and Cybernetics, Part A*, Vol. 37, No. 4, 2007, pp. 519 - 532.
- C. Hsu and W. A. Wallace, "An Industrial Network Flow Information Integration Model for Supply Chain Management and Intelligent Transportation," *Journal of Enterprise Information System*, Vol. 1, No. 3, 2007, pp. 327 - 351.
- C. Hsu and J. Spohrer, "Improving Service Quality and Productivity: Exploring the Digital Connections Scaling Model," *International Journal of Service Technology and Management*, Vol. 11, No. 3, 2009, pp. 272-292.
- J. L. Zhao, C. Hsu, H. J. Jain, J. Spohrer, M. Taniru, and H. J. Wang, "ICIS 2007 Panel Report: Bridging Service Computing and Service Management: How MIS Contributes to Service Orientation?" *Communications of the Association for Information Systems*, Vol. 22, March, 2008, pp. 413-428.
- D. Levermore, G. Babin, and C. Hsu, "A New Design for Open and Scalable Collaboration of Independent Databases in Digitally Connected Enterprises," *Journal of the Association for Information Systems*, Vol. 11, No. 7, July, 2010, pp. 367-395.
- W. K. V. Chan and C. Hsu, "Service Scaling on Hyper-Networks," *Service Science, INFORMS*

Service Science Division, Vol. 1, No. 1, March 2009, pp. 17 – 31; also available online, January 2009: <http://sersci.com/ServiceScience/>.

C. Hsu, “Service Science and Network Science,” editorial column, *Service Science*, INFORMS Service Science Division, Vol. 1, No. 2, September, 2009 pp. i - iii (online version first posted in April 2009: <http://sersci.com/ServiceScience/>)

W. K. V. Chan and C. Hsu, “How Hyper-Network Analysis Helps Understand Human Networks?” *Service Science*, INFORMS Service Science Division, Vol. 2, No. 4, 2010, pp. 270 - 280 (available online at <http://sersci.com/ServiceScience/>)

M. Steiner, J. Kanai, C. Hsu, R. Alben, and L. Gerhardt, “Holistic Assessment of Student Performance in Multidisciplinary Engineering Capstone Design Projects”, *International Journal of Engineering Education*, forthcoming.

C. Hsu, “Hyper-Networking of Customers, Providers, and Resources Drives New Service Business Designs: e-Commerce and Beyond,” *Service Science*, INFORMS, Vol. 3, No. 4, pp. 325-337 (available online in June 2011 at <http://sersci.com/ServiceScience/>).

W. K. V. Chan and C. Hsu, “Service Value Networks: Humans Hyper-Network to Cocreate Value,” *IEEE Transactions on Systems, Man, and Cybernetics, Part A*, in press for 2012.

**Conference Proceedings:** over several dozens of papers in refereed conferences by ACM, IEEE Computer Society, ASEE, Data Engineering, Entity-Relationship Approach, INFORMS, Production Research, ISEAD and others; also a few dozens more papers in committee reviewed proceedings by IEEE Systems, Man, and Cybernetics Society and several other associations.

**Technical Reports:** include several monographs published for sponsoring companies and a few dozens of papers published by the department and/or research centers.

**Impact:** e.g., Google search on the Hsu-originated word, “metadatabase”, has turned up over 200,000 entries from the professional communities.

### **Synergistic Activities for Education**

1. Development of a Computer-Aided Software Engineering tool for data and knowledge systems analysis and design. This CASE tool is an implementation of the Two-Stage Entity-Relationship method developed by the Principal Investigator. The software is downloadable from his Web site at <http://viu.eng.rpi.edu>. It has been used in the Metadatabase research projects and in classes at Rensselaer, Laval University, Hong Kong University and Swiss Federal University. Educators from several other institutions have also acquired the system. Over 200 undergraduate and 500 graduate students at Rensselaer have used the system in class to learn database design and systems analysis. There have been over 1000 known downloads of the software.

2. Development of a Virtual Laboratory for distributed learning. The virtual laboratory is a part of the above Web site and is used regularly in the classes the Principal Investigator teaches at Rensselaer. It enables a new pedagogy allowing students to take laboratory assignments on their own pace and from their own home. It consists of five self-contained studios, including complete instructions and teaching materials. More than 1000 students at Rensselaer and Clarkson Universities have used the virtual laboratory to learn homepage development, e-commerce, Web technology, data modeling, database design, Oracle database processing, and manufacturing information systems. The virtual laboratories have also been linked to LMS (WebCT) at Rensselaer for use in distance learning classes.

### **Select Research Projects in 1985 - 2011**

Principal Investigator, *Investigation and Prototyping of an Intelligent Database System: Manufacturing Knowledge Management Using Two-Stage Entity-Relationship Approach and Predicate Calculus*

Sponsoring Companies: Digital Equipment Corporation, General Motors, and Johnson and Johnson.

Co-principal Investigator, *Computer-Integrated Manufacturing Program Phase II*, Center for Manufacturing Productivity and Technology Transfer, Rensselaer Polytechnic Institute.

Sponsoring Companies: Alcoa, DEC, GE, GM, IBM, Kodak, Northrup, Norton and UTC.

Co-Principal Investigator, *Information Management for Manufacturing*

Sponsor: AT&T Foundation.

Principle Investigator, *Integration of Control and Information in Automated Manufacturing: Towards a Common Modeling Methodology and Unifying Architecture*, (with Alan A. Desrochers).

Sponsor: New York State Center for Advanced Technology, Rensselaer Polytechnic Institute.

Principal Investigator, *Knowledgebases for Heterogeneous Databases Integration* (with Carlo Batini, Italy).

Sponsor: NATO Scientific Affairs Division

Principal Investigator for the Information Management field, *Computer-Integrated Manufacturing Phase III*.

Principal Investigator, *Develop a Theoretical Model of Information Requirements in Concurrent Manufacturing Systems*, National Science Foundation, DDM9015277.

Principal Investigator, *Enterprise Information Visualization*, Digital Equipment Corporation.

Principal Investigator, *Adaptive Integrated Manufacturing Enterprises*

Sponsors: Alcoa, Digital Equipment Corporation, GE, GM, and IBM.



Principle Investigator, *Scalable Metadatabase for Enterprise Integration and Re-engineering*  
Sponsor: Samsung Electronics Co. (Korea)

Director and Principal Investigator, *Adaptive Integrated Manufacturing Enterprises: New Information Technology for the 21st Century*, National Science Foundation

Principal Investigator, *Scalable Metadatabase for Enterprise Integration and Re-engineering*, Samsung Electronic Corporation (in cooperation with Hewlett Packard).

Principal Investigator, *Integration and Management of Manufacturing Information Systems*, Army Materials Technical Laboratory and Anniston Depot (in cooperation with CIEEM/RPI).

Principal Investigator, *Developing an Enterprise Systems Studio*, Strategic Investment, RPI

Principal Investigator, *Assessment of the NYS Department of Transportation Information Resources*, New York State (with W. A. Wallace)

Co-Principal Investigator, *Strategic Planning for Advanced Intelligent Transportation Systems: A vision of Cyber-infrastructure for the Smart Corridor*, New York State (PI: G. List)

**Sponsored International Speaker:**

Invited Keynote Speaker at a few symposia, including INRIA, France; Samsung, Korea; and Chinese University, Hong Kong from 1990 - 2000.

Thai Royal Ministry of Education Seminar Speaker, Seminar on E-Business Technology, Systems, and Applications, King Mongkut Institute of Technology at Ladkrabung, Thailand, December 2003 (gave the seminar to over 50 college faculty from several universities).

Fulbright Senior Specialist: Project 1283 to the Institute of Information Industry and three other universities in Taiwan, March 2005 (sponsored by the U.S. State Department).

Keynote Speaker, Taipei Industrial Technology Innovation Conference 2007, Taipei, Taiwan, August 2007 (Sponsored by the Ministry of Economics, Taiwan).

Keynote Speaker, Service Innovation Symposium 2009, National Chung Hsin University, Taichung, Taiwan, November 25, 2009

Invited Symposium Keynote Speaker to University of Montreal, Montreal, Canada

**Sponsored Seminars and Invited Conference Speakers:**

Approximately fifty sponsored (funded) talks and seminars given to a number of universities and companies in the North America - e.g., MIT, Penn State, University of Montreal, IBM, GE, and GM; and a few dozen more presentations/session chairs to scholarly conferences around the world – e.g., IEEE, ACM, and INFORM.

**Professional Services:**

Guest Editor, Special Issue on Electronic Commerce, *IEEE Transactions on Systems, Man, and Cybernetics*, Part A, Vol. 30, No. 4, July 2000.

Associate Editor, *IEEE Transactions on Systems, Man, and Cybernetics*.

Editorial Board and Senior Editor, *INFORMS Journal of Service Science*

Chairs and members for the Program and Conference Committees for about twenty international conferences, including Conferences on Entity-Relationship Approach; IEEE Systems, Man, and Cybernetics; Computer-Integrated Manufacturing; Data Engineering; Data and Knowledge Engineering; and INFORMS.

External Examiner: the Chinese University of Hong Kong (for courses, personnel, and programs), and New York State Regent

Visiting External Examiner: reviewed the Multi-Disciplinary Operations Research Program, Penn State University (March 23-25, 2006); and the Integrated BBA Degree Program, the Chinese University of Hong Kong (May 22 – June 5, 2006)

Review Committee for Information Technology, 2007 - 2009, Fulbright Senior Specialist Program, IIS, Council for International Exchange of Scholars, State Department

**Awards:**

1991 Faculty Partner Award, Center for Manufacturing Productivity and Technology Transfer, Rensselaer Polytechnic Institute

1992, 1995, 1999 Karger Dissertation Award (Advisor), Rensselaer Polytechnic Institute

**Consulting:**

Coopers and Lybrand, *The New York State Department of Transportation Management Information System Planning Project*, 1988.

Digital Equipment Corporation, Nashua, New Hampshire, *The Repository Information Model*, 1991.

General Electric Corporation, Research and Development, *Manufacturing Information Management*, 1995 and *Monitoring and Diagnostics for Power Systems*, 1996-1997.

TRC, Inc., *Development of a Long-Range Corporate Aircraft Database*, 2005

**Patents:**

One patent on natural language database query (US # 7117798) and pending in Europe

**Industrial Activities:**

Co-Founder and Director, Enter Net, Inc. (specializing in agent-based peer-to-peer exchange technologies for e-business and enterprise integration), Troy, New York, 2000-2003.

Co-Founder, Metaworld Enterprises, Inc.

**Web Site:**

Enterprise Integration and Modeling at <http://viu.eng.rpi.edu>