

Jane Hayes

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Curriculum Vitae – January 2006

Research Interests

Software engineering:	traceability, requirement fault models, education
Software reliability:	software verification and validation, semantic modeling of software faults, software testing techniques, fault taxonomies and profiles, fault models
Software maintainability:	maintainability estimation/measurement, maintenance effort modeling, maintenance processes

Education

Ph.D., January 1999, Information Technology

George Mason University. Fairfax, VA. Advisor: A. Jefferson Offutt
Thesis: Input Validation Testing: A System Level, Early Lifecycle Technique

M.S., May 1987, Computer Science

University of Southern Mississippi, Hattiesburg, MS. Advisor: Cliff Burgess
Thesis: Partially Automated In-Line Documentation (PAID): Design and Implementation of a Software Maintenance Tool

B.A. cum laude, May 1983, Geology and Political Science (double major)

Hanover College, Hanover, IN. Advisors: J. Carl Metz and Stanley Totten

Employment History

University of Kentucky, January 2001 – present

Assistant Professor, Department of Computer Science

Science Applications International Corporation (SAIC), January 2001 – present

Technical Consultant

SAIC, October 1999 – January 2001

Corporate Vice President and Manager, Integrated System Technologies Operation
Senior Member of the Technical Staff

SAIC, February 1995 - October 1999

Vice President and Manager, Innovative Software Technologies Division
Senior Member of the Technical Staff.

SAIC, 1991 – January 1995

Assistant Vice President and Manager, IV&V Branch
Senior Member of the Technical Staff

SAIC, 1990 – 1991

Principal Investigator
Senior Member of the Technical Staff

SAIC, 1989 – 1990

Assistant Principal Investigator
Member of the Technical Staff

SAIC, 1984 – 1989

Senior Systems Analyst

University of Southern Mississippi, 1985 – 1987

Teaching Assistant

Perceptronics, Summer 1986

Applications Programmer

Defense Intelligence Agency, 1983 – 1984

Photographic Technologist

Certification and Licensure

Certified Software Test Engineer (CSTE)

Quality Assurance Institute

Certificate 1591, obtained in 1998, renewed in January 2002

Certified Investigator for Research Using Human Subjects

Collaborative Investigator Training Initiative (CITI)

University of Kentucky, Spring 2005

Publications

Refereed Journal Papers

Published or accepted:

1. **Jane Huffman Hayes**, Alex Dekhtyar, and Senthil Sundaram*, “Advancing Requirements Tracing: An Objective Look,” accepted to IEEE Transactions on Software Engineering, December 2005, awaiting press date.
2. **Jane Huffman Hayes** and Jeff Offutt⁺, “Input Validation Analysis and Testing,” accepted to Journal on Empirical Software Engineering, October 2005, awaiting press date.
3. **Jane Huffman Hayes** and Alex Dekhtyar, “A Framework for Comparing Requirements Tracing Experiments,” International Journal on Software Engineering and Knowledge Engineering (IJSEKE), Volume 15, Number 5, October 2005, pp. 751 - 781.
4. **Jane Huffman Hayes**, Alex Dekhtyar, and Senthil Sundaram*, “Improving After the Fact Tracing and Mapping to Support Software Quality Predictions,” IEEE Software, Volume 22, Number 6, November/December 2005, pp. 30 – 37.
5. Suresh Yadla*, **Jane Huffman Hayes**, Alex Dekhtyar, “Tracing Requirements to Defect Reports: An Application of Information Retrieval Techniques,” Innovations in Systems and Software Engineering: A NASA Journal, Volume 1, Number 2, September 2005, p. 116 – 124.
6. Tina Gao*, **Jane Huffman Hayes**, and Henry Cai*, “Integration Of Heterogeneous Bioinformatics Software Components Using Standardized Web Services,” IEEE Computer, March/April 2005 issue, pp. 26 - 31.
7. Alain April, **Jane Huffman Hayes**, and Alain Abran, “Software Maintenance Maturity Model (SM^{mm}): A Software Maintenance Process Model,” Journal of Software Maintenance and Evolution: Research and Practice, Volume 17, Number 3, May-June 2005, p. 197-223.
8. **Jane Huffman Hayes**, Naresh Mohamed*, Tina Gao*, “The Observe-Mine-Adopt Model: An Agile Way to Enhance Software Maintainability,” Journal of Software Maintenance and Evolution: Research and Practice, Volume 15, Issue 5, Pages 297 – 323, October 2003.
9. Sandy Patel* and **Jane Huffman Hayes**, “Case Study: Teaching an Electronic Course,” Journal for the Advancement of Marketing Education, Volume 2, Number 1, Summer 2002.

⁺ My advisor

In submission:

Jane Huffman Hayes and Jeff Offutt⁺, "Recognizing Authors: A Case Study of the Consistent Programmer Hypothesis," submitted to a journal, February 2005.

Jane Huffman Hayes, "Authorship Attribution: A Principal Component and Linear Discriminant Analysis of the Consistent Programmer Hypothesis," submitted to a journal, April 2005.

Refereed Conference/Workshop Papers

1. **Jane Huffman Hayes**, Alex Dekhtyar, Ashlee Holbrook*, Olga Dekhtyar, Senthil Sundaram*, "Will Johnny/Joanie Make a Good Software Engineer?: Are Course Grades Showing the Whole Picture?," accepted to Conference on Software Engineering Education and Training (CSEET), to be presented in Oahu in April 2006.
2. **Jane Huffman Hayes**, Ashlee Holbrook*, Inies Chemannoor*, Dave Pruett, "Fault-Based Analysis: How History Can Help Improve Performance and Dependability Requirements for High Assurance Systems," accepted to Fifth International Workshop on Requirements for High Assurance Systems (RHAS), to be presented in Chicago, IL on November 8, 2005.
3. **Jane Huffman Hayes**, Alex Dekhtyar, Senthil Sundaram*, "Humans in the Traceability Loop: Can't Live With 'Em, Can't Live Without 'Em," accepted to Workshop on Traceability of Emerging Forms of Software Engineering (TEFSE), to be presented in Long Beach, CA on November 8, 2005, pp. 20 - 23.
4. **Jane Huffman Hayes**, Liming Zhao*, "Maintainability Prediction: A Regression Analysis of Measures of Evolving Systems," accepted to IEEE International Conference on Software Maintenance (ICSM) 2005, Budapest, Hungary, September, 2005.
5. **Jane Huffman Hayes**, Alex Dekhtyar, Senthil Sundaram*, "Text Mining for Software Engineering: How Analyst Feedback Impacts Final Results," Proceedings of Workshop on Mining of Software Repositories (MSR), associated with ICSE 2005, St. Louis, MO, May 2005, pp. 58 - 62.
6. Senthil Sundaram*, **Jane Huffman Hayes**, Alex Dekhtyar, "Baselines in Requirements Tracing," Proceedings of Workshop on Predictive Models of Software Engineering (PROMISE), associated with ICSE 2005, St. Louis, MO, May 2005, pp. 12 - 17.
7. **Jane Huffman Hayes**, Inies Chemannoor*, Vinod Surisetty*, and Anneliese Andrews, "Fault Links: Exploring the Relationship Between Module and Fault Types," Proceedings of European Dependable Computing Conference (EDCC), Budapest, Hungary, April 2005.
8. **Jane Huffman Hayes**, Alexander Dekhtyar, Senthil Sundaram*, Sarah Howard, "Helping Analysts Trace Requirements: An Objective Look," in Proceedings of IEEE Requirements Engineering Conference (RE) 2004, Kyoto, Japan, September 2004, pp. 249-261.
9. **Jane Huffman Hayes**, Sandip Patel*, and Liming Zhao*, "A Metrics-Based Software Maintenance Effort Model," In Proceedings of the 8th European Conference on Software Maintenance and Reengineering, Tampere, Finland, March 2004. pp. 254-258.
10. Alex Dekhtyar, **Jane Huffman Hayes**, and Timm Menzies. "Text is Software Too," in Proceedings of the Mining of Software Repositories Workshop, Edinburgh, Scotland, May 2004, pp. 22-26.

* Student co-author

11. Jeff Offutt⁺, Yuan Yang, and **Jane Huffman Hayes**, "SEWeb: Making Experimental Artifacts Available," Workshop on Empirical Research in Software Testing (WERST), in SIGNOTES, Volume 29, Issue 5, September 2004, Boston, MA, July 2004, pp. 1 - 3.
12. **Jane Huffman Hayes**, "Building a Requirement Fault Taxonomy: Experiences from a NASA Verification and Validation Research Project," in Proceedings of the IEEE International Symposium on Software Reliability Engineering (ISSRE), Denver, CO, November 2003, pp. 49 - 59.
13. **Jane Huffman Hayes**, Alexander Dekhtyar, James Osbourne*, "Improving Requirements Tracing via Information Retrieval," in Proceedings of the International Conference on Requirements Engineering (RE), Monterey, California, September 2003, pp. 138 – 148.
14. **Jane Huffman Hayes**, Tim Lethbridge, and Dan Port, "Evaluating Individual Contribution Toward Group Software Engineering Projects," in Proceedings of the International Conference on Software Engineering (ICSE), Portland, Oregon, May 2003, pp. 622-627.
15. **Jane Huffman Hayes** and Pifu Zhang*, "Fault Detection Effectiveness of Spathic Test Data," in Proceedings of the IEEE International Conference on Engineering of Complex Computer Systems (ICECCS) 2002, Greenbelt, MD, December 2002, pp. 183-192.
16. **Jane Huffman Hayes** and Jeff Offutt⁺, "Applying a Semantic Fault Model to the Empirical Study of Corrective Maintenance," presented at and in on-line proceedings of the Eighth IEEE Workshop on Empirical Studies of Software Maintenance (WESS 2002), Montreal, Canada, October, 2002.
17. **Jane Huffman Hayes**, "Energizing Software Engineering Education through Real-World Projects as Experimental Studies," in Proceedings of the 15th Conference on Software Engineering Education and Training (CSEET), Covington, KY, February 2002, pp. 192-206.
18. **Jane Huffman Hayes**, "Affects on Maintenance of Web Software Applications," in Proceedings of the International Conference on Software & Systems Engineering and their Applications (ICSSEA), Paris, France, December 2001.
19. **Jane Huffman Hayes** and Hui Cai*, "Software Engineering and Building Multi-Tier E-Business Applications Using Web Services Technology: Forget Everything You Know?," in Proceedings of the International Conference on Software & Systems Engineering and their Applications (ICSSEA), Paris, France, December 2001.
20. **Jane Huffman Hayes** and Jeff Offutt⁺, "Product and Process: Key Areas Worthy of Software Maintainability Empirical Study," presented at and in on-line proceedings of The Sixth IEEE Workshop on Empirical Studies of Software Maintenance (WESS 2000), San Jose, California, October 2000.
21. **Jane Huffman Hayes** and Jeff Offutt⁺, "Increased Software Reliability Through Input Validation Analysis and Testing", in Proceedings of The Tenth IEEE International Symposium on Software Reliability Engineering, pages 199-209, Boca Raton, Florida, November 1999.
22. **Jane Huffman Hayes** and Jeff Offutt⁺, "Input Validation Testing: A Requirements-Driven, System Level, Early Lifecycle Technique", published in the Proceedings of the 11th International Conference on Software Engineering and its Applications, Paris, France, October 1998.
23. **Jane Huffman Hayes**, "Input Validation Testing: A System Level, Early Lifecycle Technique," accepted to ICSE '97 Doctoral Consortium, published in the Proceedings of the

⁺ My advisor

* Student co-author

Seventeenth International Conference on Software Engineering Doctoral Consortium, Boston, Massachusetts, May 1997.

24. Jeff Offutt⁺ and **Jane Huffman Hayes**, "A Semantic Model of Program Faults," published in The Proceedings of the International Symposium on Software Testing and Analysis (ISSTA), pages 195-200, ACM, San Diego, California, January 1996.
25. **Jane Huffman Hayes**, "Testing Object-Oriented Systems: A Fault-Based Approach," published in The Proceedings of the International Symposium on Object-Oriented Methodologies and Systems (ISOOMS), Springer-Verlag Lecture Notes on Computer Science series, Number 858, pages 205-220, Palermo, Italy, September 1994.
26. **Jane Huffman (Hayes)** and Cliff Burgess, "Partially Automated In-Line Documentation (PAID): Design and Implementation of a Software Maintenance Tool," published in The Proceedings of the 1988 IEEE Conference on Software Maintenance (ICSM), pages 60-65, Phoenix, Arizona, October 1988.

Refereed by Abstract

- J. H. Graham, **Jane Huffman Hayes**, R.K. Ragade, "Requirements Methods for Safety-Critical Industrial Software Systems," Proceedings of Sixth Intl. Conf. on Engineering Design and Automation (EDA), Wailea, Maui, Hawaii, August 2002, pp. 42-45.
- Steve Mirsky, Lance Miller, and **Jane Huffman Hayes**, "Development and Documentation of Verification and Validation Guidelines for Expert Systems in the Nuclear Power Industry," PLEX '93 (Plant Life Extension), Zurich, Switzerland, 29 November-1 December 1993.
- Jane Huffman Hayes**, Jeff Weatherbee, and Lillian Zelinski, "A Tool for Performing Software Interface Analysis," published in The Proceedings of the First International Conference on Software Quality, Dayton, Ohio, October 1991.
- Jane Huffman Hayes**, "Risk Reduction Through Requirements Tracing," published in The Conference Proceedings of Software Quality Week 1990, San Francisco, California, May 1990, pp. 1 - 25.

Invited Papers

- Jane Huffman Hayes**, Alex Dekhtyar, and James M. Carigan*, "Recommending a Framework for Comparison of Requirements Tracing Experiments," in on-line proceedings of the Workshop on Empirical Studies of Software Maintenance (WESS 2004), Chicago, IL, September 2004.
- Jane Huffman Hayes**, "Do You Like Pina Coladas? How Improved Communication Can Improve Software Quality," *IEEE Software*, January/February 2002, pp. 90 - 92.
- Jane Huffman Hayes**, "On the Virtues of Not Knowing," *IEEE Software*, May/June 2004, pp. 74 - 75.

Editorial Work

The Proceedings of the ACM 3rd International Workshop on Traceability in Emerging Forms of Software Engineering TEFSE 2005, J.I. Maletic, J. Cleland-Huang, **J. H. Hayes**, G. Antoniol (Editors), November 8th, Long Beach California, ACM, ISBN 1-59593-243-7, 2005.

Other Publications

Lance Miller, Steve Mirsky, and **Jane Huffman Hayes**, NUREG/CR-6316, Guidelines for the Verification and Validation of Expert System Software and Conventional Software, U.S. Nuclear Regulatory Commission and Electric Power Research Institute, March 1995.

Patents and Invention Disclosures

Patent Pending, "Integration of Microarray Data Analysis Application through Web Services Technology for Drug Target Identification," with Hong Gao and Hui Cai, submitted by University of Kentucky for provisional patent, November 2003.

Under Review, "REquirements TRacing On target (RETRO)," with Alex Dekhtyar and Senthil Sundaram. Submitted for NASA intellectual property review, August 2004.

Grants

Current Support:

Principal Investigator (PI), "Assessment of Requirements Traceability Matrices," \$50K, 9/29/05 – 9/28/06, NASA IV&V Facility and Goddard Space Flight Center (GSFC).

PI, "Fault-Based Analysis: Improving IV&V Through Requirements Risk Reduction," 11/2003 – 10/2006, \$194.3K, Johnson Space Center (JSC) via NASA's IV&V Facility.

Past Support:

PI, "Improving Requirements Tracing and IV&V via Information Retrieval and Text Mining," \$134.9K, 9/1/04 – 8/30/05, NASA IV&V Facility and GSFC.

Co-PI, "Robust Requirements Tracing via Internet Search Technology: Improving an IV&V Technique, Phase II," 2/15/03 – 7/31/04, \$86K, NASA IV&V Facility and GSFC.

PI, "Fault-Based Analysis: Improving IV&V Through Requirements Risk Reduction," 1/2002 – 9/30/2002, \$112K, NASA IV&V Facility and GSFC.

PI, "Robust Requirements Tracing via Internet Search Technology: Improving an IV&V Technique," 3/1/02 – 2/28/03, \$46K, NASA's GSFC.

PI, "Gerald N. Galstan Memorial Fellowship," 1/01 – 5/03, \$26K, – SAIC.

PI, "Voice Recognition for Procedure Automation on Body Wearables in a High Noise Environment," 6/99 – 1/00, \$200K, SAIC Corporate (Internal R&D).

PI, "Speech and Natural Language Processing," 1/00 – 12/00, \$30K, \$30K, 1/00 – 12/00, SAIC Corporate (Internal R&D).

PI, "Input Validation Testing: A System Level, Early Lifecycle Technique," ~1/98 – 1/99, ~\$200K, partially funded by U.S. Navy.

Assistant PI, "Guidelines for the Verification and Validation of Expert System Software and Conventional Software," ~6/91 – 6/93, \$474K, U.S. Nuclear Regulatory Commission and Electric Power Research Institute.

Pending Proposals:

Co-PI, "Impact of Community Models on Child's Physical Activity," submitted to NIH, total cost of \$346K for 2 years.

PI, "Visualization for Software Maintenance," \$100K for 2 years, submitted to KSEF.

PI, "Fault-Based Software Maintenance: A Framework for Improved Software Reliability and Maintainability," ~\$500K for 5 years, submitted to NSF.

Invited Talks

Jane Hayes "Software Engineering: A Personal Perspective," University of Kentucky Association for Computing Machinery (ACM) Student Chapter meeting, November 2005.

Jane Hayes, "Fault Links and Models for Software Maintainability," University of Louisville, Louisville, KY, June 2005.

- Jane Hayes, "Improving Requirements Tracing from the Analyst's Perspective (using IR Techniques)," University of Waterloo, Canada, April 2005.
- Jane Hayes, "Software Engineering: Research and Careers," Centre College, October 2004.
- Jane Hayes, "What is Software Assurance?," panel at NASA OSMA Software Assurance Symposium, September 2002.
- Jane Hayes, "A Semantic Fault Model Applied to the Empirical Study of Corrective Maintenance: A Work in Progress," University of Maryland, May 2002.
- Jane Hayes, "Topics in Software Verification and Validation: Requirements Tracing," University of Louisville, January 2001.
- Jane Hayes, "Industry/Academia: Horse of a Different Color?," Technology Leadership Forum, Lexington, KY, December 2001.
- Jane Hayes, "Success Criteria/Exit Criteria/Stopping Criteria: Managing Results and Expectations," invited talk, presented at 21st Annual International Conference on Software Testing, Orlando, Florida, October 2001.
- Jane Hayes, "Buyer Beware: Who Certified Your Software Certifier?," speech for First International Software Certification Conference 1999 (ISACC '99), Dulles, Virginia, March 1999.
- Jane Hayes and Chris Stoddard, "Risk Determination Using the SAIC Risk Cube", presented at the NASA Workshop on Risk Management, Nemaquin, Pennsylvania, October 1998.

Honors and Awards

- "Best Research Award" with Alex Dekhtyar, August 2005, NASA, for "Improving Requirements Tracing and IV&V via Information Retrieval and Text Mining" project
- "The Buzz Research Award," with Alex Dekhtyar, August 2003, NASA, from NASA, for "Robust Requirements Tracing via Internet Search Technology: Improving an IV&V Technique, Phase II" project

Publicly Available Software Tools and Data Sets

- RETRO – requirements tracing tool
- PheTracker – phenylalanine tracking tool for PDAs
- MODIS dataset – SEEWEB, PROMISE
- CM-1 dataset – SEEWEB, PROMISE
- Observe-Mine-Adopt model

Professional Activities

- Editorial Board* of IEEE Software, January 2002 - present
- Co-editor*, Quality Time column of IEEE Software, January 2002 - present
- Program Committee*, 28th Intl. Conf. on Software Engineering (ICSE), Shanghai, China 20-28 May 2006, Experience Track
- Program Committee*, Workshop on Technology Transfer in Software Engineering (WOTTSE) 2006, in association with ICSE 2006
- Program Committee*, IEEE Int'l Conf on Requirements Engineering, 2006
- Program Committee*, Predictive Models of Software Engineering (PROMISE), 2006
- Program Committee*, 15th Conference on Software Engineering Education and Training (CSEET), 2006
- Program Committee*, Workshop on Mining of Software Repositories (MSR), 2005, 2006

Organizing Committee and Program Committee, Workshop on Traceability for Emerging Forms of Software (TEFSE) 2005, in conjunction with Automated Software Engineering (ASE)

Program Committee, IEEE International Conference on Engineering of Complex Computer Systems (ICECCS), 2001, 2002, 2004 (no conference in 2003), 2005

Co-chair, Workshop on Empirical Studies of Software Maintenance (WESS) 2004

Program Committee, International Computer Software and Applications Conference (COMPSAC), 2003, 2004

Program Committee, 9th International IEEE Software Metrics Symposium (METRICS)

Program Committee, Eighth IEEE International Symposium on High Assurance Systems Engineering (HASE)

Review Activities:

Editorial Board Member: Software Quality Journal, IEEE Software

Referee: IEEE Transactions on Software Engineering (TSE), IEEE Software, International Journal on Software Engineering and Knowledge Engineering, Information and Software Technology, Journal on Software and System Modeling (SoSyM), Software Quality Journal

Reviewed a chapter of the Encyclopedia of Software Engineering (2 vol) (Wiley)

Service

Computer Science Community

See Professional Activities above

Invited panelist, NSF, re-definition of the SBIR IT program

Invited panelist, NSF, three panels

Standing Department Committees

2003 – present, Member, Accreditation committee (accreditation visit for undergraduate program was October 16 – 18, 2005)

2002 – present, Member, Undergraduate curriculum committee

2002 – present (as tasked), assist Graduate Admissions committee

2003 – present, Systems Group

Ad Hoc Department Committees

2003 – present, Committee to Develop Portfolio Evaluation Criteria and Process

2002 Undergraduate laboratory specification development committee

2001 Organizer and coordinator of regular meetings of the Synergistic Laboratory for Advanced Networking Team (SLANT)

College and University

See University and Public Service attachment

Educational Activities

Courses Developed and Taught

CS 650 Software Engineering, renumbered as 616

CS 499 Senior Design project

CS 685 Requirements Engineering, renumbered as 617

CS 685 Software Design, renumbered as 618

CS 685 Software Test and Software Quality Evaluation, renumbered as 619

Students Graduated

Hui Cai (Henry), M.S., September 2001.
Julia Shi, M.S., May 2002.
Tina Gao, M.S. (thesis option), Fall 2003.
Veer Patel, M.S., spring 2004.
Jenchi Cheng, M.S., summer 2004.
Inies Chemannoor, M.S. (thesis option), September 2004.
Suresh Yadla, M.S., December 2004.
Selva Prasanna, M.S., February 2005.
Srividya Adusumilli, M.S., March 2005.
Ignatius Vijai Ignatius, M.S., April 2005.

Current Students

Ph.D.

Liming Zhao, expected 2007, passed all breadth exams and depth exam.
Senthil Sundaram, expected 2007, passed all breadth exams, depth exam in progress.
Ashlee Holbrook, Ph.D. expected, 2007, passed one breadth exam and depth exam.
Bill Kidwell, Ph.D. expected, 2010.
Jim Carigan, Ph.D. expected, 2010.
Inies Chemmannoor, M.S. completed September 2004; Ph.D. expected 2009.

M.S. – 7 students currently

Independent Studies

Spring 2003 – 2
Summer 2003 – 1
Fall 2003 – 2
Spring 2004 – 3
Fall 2004 – 4
Spring 2005 - 8

Graduate Project/Thesis Committees

Spring 2003 – 1
Fall 2003 – 4
Spring 2004 – 2
Summer 2004 – 1 M.S., 1 Ph.D.
Fall 2004 – 2
Spring 2005 - 6

See attached Teaching Portfolio for additional information

Professional Memberships

Member of IEEE Computer Society