

Gregory D. Hager
Department of Computer Science
The Johns Hopkins University
3400 N. Charles St.
Baltimore, Maryland 21218
<http://www.cs.jhu.edu/~hager>
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EDUCATION

Ph.D. in Computer Science, University of Pennsylvania, 1988
Dissertation: Active Reduction of Uncertainty in Multi-Sensor Systems
Advisor: Dr. Max Mintz

M.S.E. in Computer Science, University of Pennsylvania, 1985
Thesis: Computational Aspects of Proofs in Modal Logic
Advisor: Dr. Dale Miller

B.A. *Summa Cum Laude*, Luther College, Decorah, Iowa, 1983
Thesis: Heuristic Programming

ACADEMIC POSITIONS HELD

Chairman, Department of Computer Science
Johns Hopkins University, 2010-present.

Deputy Director, Center for Computer-Integrated Surgical Systems and Technology
Johns Hopkins University, 2005-present.

Faculty, Graduate School of Informatics and Science in Health
Technical University of Munich, 2009-present.

Visiting Professor of Computer Science, Stanford University, 2007-2008.

Professor of Computer Science with secondary appointment in **Mechanical Engineering**
Johns Hopkins University, 1999-present.

Associate Professor of Computer Science with secondary appointment in **Electrical Engineering**
Yale University, 1996-1999.

Assistant Professor of Computer Science
Yale University, 1991-1996.

Post-doctoral Research Fellow
University of Pennsylvania, 1990.

Fulbright Fellow
Fraunhofer Inst., IITB & University of Karlsruhe, 1988-1990.

Summer Research Staff
SRI International, 1984.

Summer Research Staff
IBM T.J. Watson Research Center, 1983.

PROFESSIONAL AWARDS

Fellow of the IEEE, 2006

Best Paper Awards:

Best Paper, Runner up, SPIE Ultrasonics 2009
Best Poster, SPIE Ultrasonics 2006, 2009
Best Journal Paper, Computer-Aided Surgery 2005
Best Student Paper, MICCAI 2005

Best Paper Nominations:

MICCAI, 2011
Intelligent Robots and Systems, 2004
IEEE Trans. on Robotics and Automation, 1996.
International Symposium on Robotics Research, 1989.

Yale Junior Faculty Fellowship, 1995.

Fulbright Post-doctoral Junior Research Fellowship, 1988.

Rubinoff Dissertation Prize, University of Pennsylvania, 1988.

IBM Graduate Fellowship in Manufacturing and Automation, 1986.

National Science Foundation Graduate Fellowship, 1983.

PROFESSIONAL ACTIVITIES

Community Service:

Computing Community Consortium (CCC) Council Member, 2011-present
Chair, Computer and Robot Vision Technical Committee of the IEEE Robotics
and Automation Society, 1996-2000.

Editorial Boards:

IEEE Transactions on Pattern Analysis and Machine Intelligence, 2008-present
International Journal of Computer Vision, 2004-present
IEEE Transactions on Robotics and Automation, 1997-2000.
Pattern Analysis and Applications, 1997-present.

Editor:

Special Issue of IJRR on Vision and Robotics, 2011
Special Joint Issue of IJRR and IJCV on Vision and Robotics, 2006
Special Issue of the IEEE Transactions on Robotics and Automation on Visual Servoing, 1996.

Organizer:

Task Modeling and Recognition for Skill Assessment and Automation in Robotic Surgery, ICRA 2011.
M2CAI, MICCAI, 2009.
Advanced Sensing for Computer-Integrated Surgery, ICRA, 2009.
Tutorial on Computer-Integrated Surgery, ICRA, 2006.
Tutorial on Computer-Integrated Surgery, MICCAI, 2005.
Workshop on Programming Methods in Robotics, CIRA 2001.
Tutorial in Vision-Based Robotics, CIRA 2001.
Dagstuhl Workshop on Sensor-Based Robotics, 2000.
Tutorial on Dynamic Vision, AAAI 2000.

Workshop and Tutorials Chair, CVPR 2000.
Workshop on Robust Vision for Control of Motion, 1998.
Block Island Workshop on Vision and Control, 1997.
Tutorial on Visual Control of Motion, 1996.
Workshop on Visual Servoing, 1994.

Visiting Review Committees:

German Aerospace Institute for Mechatronics and Robotics, 2009
UCSD Dept. of Computer Science, 2008
German Aerospace Institute for Mechatronics and Robotics, 2005
INRIA, Computer Vision Research, 2004

Program or Area Chair:

Program Chair, Computer Vision and Pattern Recognition, 2013
Area Chair, Computer Vision and Pattern Recognition, 2005, 2006, 2007, 2008, 2009, 2012
Medical Image Computing and Computer Assisted Intervention, 2005

Program Committees:

Computer Vision and Pattern Recognition, 2003, 2004
Medical Image Computing and Computer Assisted Intervention, 2002, 2003, 2006, 2007
Vision Interfaces, 2002, 2003
International Conference on Computational Intelligence in Robotics and Automation, 2001
International Symposium on Robotics with Applications 2000.
Vision Algorithms Workshop (with ICCV'99), 1999.
Third Haskell Workshop (with ICFP'99), 1999.
IEEE International Conference on Computer Vision and Pattern Recognition 1996-1999.
International Conference on Computer Vision 1999.
International Conference on Robotics and Automation 1997,1999-2002,2005.
World Manufacturing Congress, 1997.
AAAI Conference 1996.
International Symposium on Robotics and Manufacturing 1996.
Multisensor Fusion and Integration for Intelligent Systems, 1994, 1996.
IEEE International Conference on Intelligent Robotics Systems, 1994, 1996, 2001.
SPIE Sensor Fusion Workshop 1991-1997.

Invited Speaker (Recent Selected):

2011 Challenges in Robotics: Down to Earth, DLR, Munich, Germany
2011 Frontiers of Computer Science, Northwestern University
2011 Workshop on Image-Guided Interventions, IROS, 2011
2011 Dutch Institute on Systems and Control Summer School
on Dynamics and Control Problems in Medical Robotics
2011 ETH, Zurich Switzerland
2010 Scientific Computing Institute (SCI), University of Utah
2010 University of Washington Medical Robotics Summer School
2010 TU Munich International Graduate School in HealthCare
2010 Keynote Speaker, Medical and Interventional Robotics Association (MIRA)
2009 University of Minnesota
2009 University of Pennsylvania
2009 Technical University of Munich
2008 National Institutes of Health
2008 Keck Octane Panel on Medical Robotics

2007 Technical University of Munich

Technical Consulting and Advisory Boards:

Clear Guide Medical (founding CEO).
STI Medical Systems, Inc. (current).
Ikona Medical, Inc. (current).
Strider Labs, Inc.
Smart Systems Technology
ABB Inc.
Siemens
United Technologies Research Center
Microsoft Inc.

University Service:

University Business School Dean's search committee, 2011
JHU Systems Institute Executive Board, 2011-present
Engineering for Professionals Computer Science Advisory Committee, 2010-present
Health Informatics Certificate Advisory Committee, 2010-present
University Academic Council, 2009-2010
University Provost Search Committee, 2008
Founding Advisor, JHU Robotics Club, 2008-present
Director of JHU-TUM International Exchange, 2007-present
Whiting School International Affairs Advisory Committee, 2008-2010
University Library Advisory Committee, 2003-2007

PUBLICATIONS

Journal Articles:

1. Gregory D. Hager and Ben Wegbreit. Scene Parsing Using a Prior World Model. *International Journal of Robotics Research*, 2011. doi: 10.1177/0278364911399340.
2. Sharmishta Seshamani, Rajesh Kumar, Gerard Mullin, Themistocles Dassopoulos, Gregory D. Hager: A Meta Method for Image Matching. *IEEE Trans. Med. Imaging* 30(8): 1468-1479, 2011.
3. Hassan Rivaz, Emad Boctor, Michael A. Choti, Gregory D. Hager: Real-Time Regularized Ultrasound Elastography. *IEEE Trans. Med. Imaging* 30(4): 928-945, 2011.
4. Zachary A. Pezzementi, Erion Plaku, Caitlin Reyda, Gregory D. Hager: Tactile-Object Recognition From Appearance Information. *IEEE Transactions on Robotics* 27(3): 473-487, 2011.
5. Carol E. Reiley, Henry C. Lin, David D. Yuh, Gregory D. Hager. A Review of Methods for Objective Surgical Skill Evaluation. *Surgical Endoscopy*, 25(2):356-366, 2011.
6. Raphael Sznitman, Manaswi Gupta, Gregory D. Hager, Paulo E. Arratia, and Josu Sznitman. Multi-environment model estimation for motility analysis of *caenorhabditis elegans*. *CoRR*, abs/1007.1398, 2010.
7. Hanzi Wang, Daniel Mirota, and Gregory D. Hager. A generalized kernel consensus based robust estimator. *IEEE Transactions on Pattern Analysis and Machine Intelligence*, 32(1):178-184, 2010.
8. Alexandre Krupa, Gabor Fichtinger, and Gregory D. Hager. Real-time motion stabilization with b-mode ultrasound using image speckle information and visual servoing. *International Journal of Robotics Research*, 28(10):1334-1354, 2009.

9. Jason Corso and Gregory D. Hager. Image description with features that summarize. *Computer Vision and Image Understanding*, 113, pp. 446-458, 2009.
10. Hassan Rivaz, Emad Boctor, Pezhman Foroughi, R. Zellars, Gabor Fichtinger, and Gregory D. Hager. Ultrasound elastography: A dynamic programming approach. *IEEE Trans. Med. Imaging*, 27(10):1373-1377, 2008.
11. J. Corso and D. Burschka, and G. Hager. A Practical Paradigm and Platform for Video-Based Human-Computer Interaction. *IEEE Computer*, 2008, 42(5):48-55, 2008.
12. Maneesh Dewan, Gregory D. Hager, and Christine H. Lorenz. Image-based coronary tracking and beat-to-beat motion compensation: Feasibility for improving coronary MR angiography. *Magnetic Resonance in Medicine*, 60(3):604-615, 2008.
13. Hanzi Wang, Daniel Mirota, Gregory Hager, and Masaru Ishii. Anatomical reconstruction from endoscopic images: Toward quantitative endoscopy. *American Journal of Rhinology*, 22(1):47-51, January/February 2008.
14. B. Vagvolgyi, C. Reiley, G. Hager, R. Taylor, and L.M. Su. Augmented Reality Using Registration Of 3d Computed Tomography To Stereoscopic Video Of Laparoscopic Renal Surgery. *Journal of Urology*, 179(4):241-241, 2008.
15. Henry C. Lin, Izhak Shafran, David Yuh, Gregory D. Hager. Towards Automatic Skill Evaluation: Detection and Segmentation of Robot-Assisted Surgical Motions. *Computer Aided Surgery*, 11(5):220-230, September 2006.
16. Le Lu and Xiang-tian Dai and Gregory D. Hager. Efficient particle filtering using RANSAC with application to 3D face tracking. *Image Vision Computing*, 24(6):581-592, June 2006.
17. Darius Burschka and Ming Li and Russell Taylor and Gregory D. Hager and Masaru Ishii. Scale-Invariant Registration of Monocular Endoscopic Images to CT-Scans for Sinus Surgery. *Medical Image Analysis*, 9(5):413-439, October 2005. (**Best Paper Award**)
18. Jason J. Corso and Guangqi Ye and Gregory D. Hager. Analysis of Multi-Modal Gestures with a Coherent Probabilistic Graphical Model. *Virtual Reality*, 8(4):242-252, September 2005.
19. Darius Burschka, Jason J. Corso, Maneesh Dewan, William W. Lau, Ming Li, Henry Lin, Panadda Marayong, Nicholas A. Ramey, Gregory D. Hager, Brian Hoffman, David Larkin, and Christopher J. Hasser. Navigating inner space: 3-D assistance for minimally invasive surgery . *Robotics and Autonomous System*, 52(1):5-26, 2005.
20. D. Kragic, P. Marayong, M. Li, A.M. Okamura, and G.D. Hager. Human-Machine Collaborative Systems for Microsurgical Applications. *The International Journal of Robotics Research*, 24(9):731-741, 2005.
21. Guangqi Ye, Jason J. Corso, Darius Burschka, and Gregory D. Hager. Vics: A modular hci framework using spatio-temporal dynamics. *Machine Vision and Applications*, 16(1):13-20, 2004.
22. A. Bettini, P. Marayong, S. Lang, A. M. Okamura, and G. D. Hager, "Vision Assisted Control for Manipulation Using Virtual Fixtures," *IEEE Transactions on Robotics*, Vol. 20, No. 6, pp. 953-966, 2004.
23. D. Rothbaum, J. Roy, G. Hager, R. Taylor, L. Whitcomb, H. Francis, and J. Niparko. Task performance in stapedotomy: Comparison between surgeons of different experience levels. *Otolaryngology - Head and Neck Surgery*, 2003.

24. Myron Z. Brown, Darius Burschka, and Gregory D. Hager. Advances in Computational Stereo. *IEEE Transactions on Pattern Analysis and Machine Intelligence*, 25(8):993-1008, 2003.
25. Joint Probabilistic Techniques for Tracking Multi-Part Objects (with C. Rasmussen). *IEEE PAMI*, 23(6): pp. 560-576, 2001.
26. Object Pose from Video Images (with C-P. Lu and E. Mjolsness). *PAMI* 22(6): pp. 610-622, 2000
27. What Tasks Can Be Performed with an Uncalibrated Stereo Vision System? (with J. Hespanha, Z. Dodds, and A.S. Morse). The *International Journal of Computer Vision*, 35(1): pp. 65-85, Nov. 1999.
28. Incremental Focus of Attention for Robust Visual Tracking (with K. Toyama). The *International Journal of Computer Vision*, 35(1): pp. 45-63, Nov. 1999.
29. Tracking in 3D: Image Variability Decomposition for Recovering Object Pose and Illumination (with P. Belhumeur). *Pattern Analysis and Applications*, March, 1999.
30. Efficient Region Tracking with Parametric Models of Geometry and Illumination (with P. Belhumeur). *IEEE Transactions on Pattern Analysis and Machine Intelligence*, 20(10), pp. 1125-1139, 1998.
31. The XVision System: A General-Purpose Substrate for Portable Real-Time Vision Applications (with K. Toyama). *Computer Vision and Image Understanding*, 69(1), pp. 23-37, 1998.
32. A Modular System for Robust Hand-Eye Coordination Using Feedback from Stereo Vision. *IEEE Transactions on Robotics and Automation*, 13(4) pp. 582-595, 1997.
33. A Tutorial Introduction to Visual Servo Control (with S. Hutchinson and P. Corke). *IEEE Transactions on Robotics and Automation*, 12(5) pp. 651-670, 1996 (**one of five nominated for best transactions article of 1996**).
34. Online Computation of Exterior Orientation with Application to Hand-Eye Calibration (with C.P. Lu and E. J. Mjolsness). *Mathematical and Computer Modeling*, 24(5), pp. 121-143, 1996.
35. Robot Feedback Control Based on Stereo Vision: Towards Calibration-Free Hand-Eye Coordination (with W. Chang and A.S. Morse). *IEEE Control Systems Magazine*, 15(1), pp. 30-39, 1995.
36. Task-Directed Computation of Qualitative Decisions from Sensor Data. *IEEE Transactions on Robotics and Automation*, 10(4), pp. 415-429, 1994.
37. Solving Large Systems of Non-Linear Constraints with Application to Data Modeling. *Interval Computations*, 2, pp. 169-200, 1994.
38. Real-Time Vision-Based Robot Localization (with S. Atiya). *IEEE Transactions on Robotics and Automation*, 9(6), pp. 785-800, 1993.
39. Computational Methods for Task-Directed Sensor Data Fusion and Sensor Planning (with M. Mintz). *International Journal of Robotics Research*, 10(4), pp. 285-313, 1991.

Books:

40. *Task-Directed Sensor Fusion and Planning*. Kluwer, Boston, 1990.
41. *The Confluence of Vision and Control* (with D. Kriegman, and A.S. Morse, Editors) LNCIS series, Springer-Verlag, 1998.

42. *Robust Vision for Vision-Based Control of Motion* (with M. Vincze, Editor) IEEE Computer Society Press, 1999.
43. *Sensor-Based Robots* (with H. Christensen, Editor) LNCS series, Springer-Verlag, 2001.

Book Chapters:

44. G. D. Hager. Human-Machine Cooperative Manipulation with Vision-based Motion Constraints in Visual Servoing via Advanced Numerical Methods. Graziano Chesi and Koichi Hashimoto, editors, 2010.
45. Henrik I. Christensen and Gregory D. Hager. Sensing and estimation. In Bruno Siciliano and Oussama Khatib, editors, Springer Handbook of Robotics, pages 87-107. 2008.
46. Guangqi Ye and Jason J. Corso Gregory D. Hager. Real-Time Vision for Human-Computer Interaction, chapter 7: Visual Modeling of Dynamic Gestures Using 3D Appearance and Motion Features. Springer-Verlag, 2005.
47. Research Issues in Vision and Control (with D. Kriegman and A.S. Morse) in *The Confluence of Vision and Control* (G. Hager D. Kriegman, and A.S. Morse, Editors) LNCIS series, Springer-Verlag, 1998.
48. Feature-Based Visual Servoing and its Application to Telerobotics (with G. Grunwald and K. Toyama). In V. Graefe, editor, *Intelligent Robotic Systems*, Elsevier, Amsterdam, 1995.
49. Robust Linear Rules for Nonlinear Systems. In J.K. Aggarwal, editor, *Multisensor Fusion for Computer Vision*, Springer-Verlag, 1993.
50. Automatic Sensor Search and Positioning for Geometric Tasks (with M. Mintz). In S. Chen, editor, *Recent Advances in Spatial Reasoning*, Ablex, 1990.

Reviews, Editorials:

51. Computational Vision at Yale (with Peter N. Belhumeur, James S. Duncan, Drew V. McDermott, A. Stephen Morse, Steven W. Zucker) *International Journal of Computer Vision* 35(1): 5-12, November 1999
52. Introduction to the Special Section on Vision-Based Control of Robot Manipulators (with S. Hutchinson). *IEEE Transactions on Robotics and Automation*, 12(5) pp. 649-650, 1996.
53. A Review of *Active Vision*. *IEEE Expert*, 8(4), 1993.

Invited Articles:

54. Daniel J. Mirota, Gregory D. Hager, and Masaru Ishii. Video-based navigation in image-guided interventions. *Annual Review of Biomedical Engineering*, 13(1), 2011. In press.
55. P. Kazanzides, G. Fichtinger, GD Hager, AM Okamura, LL Whitcomb, and RH Taylor. Surgical and Interventional Robotics-Core Concepts, Technology, and Design. *Robotics & Automation Magazine, IEEE*, 15(2):122-130, 2008.
56. G. Fichtinger, P. Kazanzides, AM Okamura, GD Hager, LL Whitcomb, and RH Taylor. Surgical and interventional robotics: Part II. *Robotics & Automation Magazine, IEEE*, 15(3):94-102, 2008.

57. GD Hager, AM Okamura, P. Kazanzides, LL Whitcomb, G. Fichtinger, and RH Taylor. Surgical and interventional robotics: part III [Tutorial]. *Robotics & Automation Magazine, IEEE*, 15(4):84-93, 2008.
58. Darius Burschka and Gregory D. Hager. Principles and Practice of Real Time Tracking on Consumer Hardware . In Tututial 1 at IEEE VR2003: Recent Methods for Image-Based Modeling and Rendering, pages 55-66, March 2003.
59. Human-Machine Cooperative Manipulation With Vision-Based Motion Constraints, Workshop on Visual Servoing, (with IROS 2002).
60. FROB: A Transformational Approach to the Design of Robot Software (with J. Peterson), Proceedings of the Ninth International Symposium on Robotics Research, Springer Verlag, 2000, pages 257-264.
61. Tracking in 3D: Image Variability Decomposition for Recovering Object Pose and Illumination (with P. Belhumeur). In the Proceedings of the International Conference on Pattern Analysis and Applications, pp. 93-102.
62. Toward Domain-Independent Navigation: Dynamic Vision and Control, (with D. Kriegman, A. Georgiades and O. Ben-Shahar). In the proceedings of the IEEE Conference on Decision and Control, special session on active vision, 1998.
63. Vision-Based Robot Control (with P. Corke). In *Control Problems in Robotics and Automation*, Springer Verlag Lecture Notes in Control and Information Sciences 230, pp. 177-190, 1997.
64. Modeling and Control for Mobile Manipulation in Everyday Environments (with W. Feiten, W. Magnussen and K. Toyama). In the *Proceedings of the 1997 International Symposium on Robotics Research*.
65. A Projective Framework for Constructing Accurate Hand-Eye Systems (with Z. Dodds). In the *Proceedings of the IEEE/RSJ/INRIA Workshop On New Trends in Image-Based Robot Servoing*, pp. 71-82, 1997.
66. The XVision System: A Paradigm for Real-Time Vision. In *Visual Modules: Proceedings of the 19th ÖAGM and 1st SDVR Workshop*, pp. 11-28, 1995.
67. Sensor planning for reactive robot programs (with G. Grunwald). In *Proceedings of the Allerton Conference on Communications, Computing and Control*, Oct., 1992.

Peer-Reviewed Conferences:

68. Rogrio Richa, Marcin Balicki, Eric Meisner, Raphael Sznitman, Russell H. Taylor, Gregory D. Hager: Visual Tracking of Surgical Tools for Proximity Detection in Retinal Surgery. *IPCAI 2011*: 55-66.
69. Raphael Sznitman, Anasuya Basu, Rogrio Richa, Jim Handa, Peter Gehlbach, Russell H. Taylor, Bruno Jedynak, Gregory D. Hager: Unified Detection and Tracking in Retinal Microsurgery. *MICCAI (1) 2011*: 1-8
70. Hassan Rivaz, Emad Boctor, Michael A. Choti, Gregory D. Hager: Ultrasound Elastography Using Three Images. *MICCAI (1) 2011*: 371-378
71. Hassan Rivaz, Emad Boctor, Michael A. Choti, Gregory D. Hager: Ultrasound Elastography Using Three Images. *MICCAI (1) 2011*: 371-378.

72. Brian C. Becker, Robert A. MacLachlan, Gregory D. Hager, Cameron N. Riviere: Handheld micromanipulation with vision-based virtual fixtures. ICRA 2011: 4127-4132
73. Nicolas Padoy, Gregory D. Hager: Human-Machine Collaborative surgery using learned models. ICRA 2011: 5285-5292.
74. Zachary A. Pezzementi, Caitlin Reyda, Gregory D. Hager: Object mapping, recognition, and localization from tactile geometry. ICRA 2011: 5942-5948.
75. Ali Uneri, Sebastian Schafer, Daniel Mirotu, Sajendra Nithiananthan, Yoshito Otake, Sureerat Reungamornrat, Jongheun Yoo, Webster Stayman, Douglas D. Reh, Gary L. Gallia, Jay Khanna, Gregory D. Hager, Russell H. Taylor, Gerhard Kleinszig, and Jeffrey H. Siewerdsen. Architecture of a high-performance surgical guidance system based on c-arm cone-beam ct: software platform for technical integration and clinical translation. In *Medical Imaging 2011: Visualization, Image-guided Procedures and Modeling*. Proceedings of the SPIE, volume 7964. SPIE, February 2011.
76. Daniel Mirotu, Ali Uneri, Sebastian Schafer, Sajendra Nithiananthan, Douglas D. Reh, Gary L. Gallia, Russell H. Taylor, Gregory D. Hager, and Jeffrey H. Siewerdsen. High-accuracy 3d image-based registration of endoscopic video to c-arm cone-beam ct for image-guided skull-base surgery. In *Medical Imaging 2011: Visualization, Image-guided Procedures and Modeling*. Proceedings of the SPIE, volume 7964. SPIE, February 2011.
77. Erion Plaku and Gregory D. Hager. Sampling-based motion and symbolic action planning with geometric and differential constraints. In *IEEE International Conference on Robotics and Automation*, Anchorage, AK, May 2010.
78. Zachary Pezzementi, Erica Jantho, Lucas Estrade, Gregory D. Hager. Characterization and Simulation of Tactile Sensors. In *Haptics Symposium*, pages 199-205, Waltham, MA, March 2010.
79. Carol E. Reiley, Chi Ciung Grace Chen, and Gregory D. Hager. Skill assessment for robotic surgery using statistical models: Language of surgery. *American Urogynecologic Society (AUGS)*, 2010.
80. Carol E. Reiley, Erion Plaku, and Gregory D. Hager. Motion generation of robotic surgical tasks: Learning from expert demonstrations. In *32nd Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC)*, Buenos Aires, Argentina, Sept 2010.
81. Pezhman Foroughi, Hassan Rivaz, Ioana N. Fleming, Gregory D. Hager, and Emad M Boctor. Tracked ultrasound elastography (true). In *Medical Image Computing and Computer Integrated surgery (MICCAI)*, pages 9-16, 2010.
82. Pezhman Foroughi, Gregory D. Hager, Frank K. Wacker, and Emad M Boctor. Application of external tracking in ultrasound elasticity imaging. In *Medical Imaging 2010: Ultrasonic Imaging, Tomography, and Therapy*, page 76291B, 2010.
83. Narges Ahmidi, Gregory D. Hager, Lisa Ishii, Gabor Fichtinger, Gary L. Gallia, , and Masaru Ishii. Task and skill classification from eye tracking and tool motion in minimally invasive surgery. In *Medical Image Computing and Computer Integrated surgery (MICCAI)*, pages 295-302, 2010.
84. Sharmishta Seshamani, Rajesh Kumar, Themis Dassopoulos, Gerard Mullin, and Gregory D. Hager. Augmenting capsule endoscopy diagnosis: A similarity learning approach. In *Medical Image Computing and Computer Integrated surgery (MICCAI)*, pages 454-462, 2010.
85. Elmar Mair, Gregory D. Hager, Darius Burschka, Michael Suppa, and Gerd Hirzinger. Adaptive and generic corner detection based on the accelerated segment test. In *ECCV (2)*, pages 183-196, 2010.

86. Andre Gaschler, Darius Burschka, and Gregory D. Hager. Epipolar-based stereo tracking without explicit 3d reconstruction. In ICPR, pages 1755-1758, 2010.
87. Raphael Sznitman, Seth Billings, Diego Rother, Daniel Mirotu, Yi Yang, James Handa, Peter Gehlbach, Jin U. Kang, Gregory D. Hager, and Russell H. Taylor. Active multispectral illumination and image fusion for retinal microsurgery. In IPCAI, pages 12-22, 2010.
88. Raphael Sznitman, Diego Rother, James Handa, Peter Gehlbach, Gregory D. Hager, and Russell H. Taylor. Adaptive multispectral illumination for retinal microsurgery. In MICCAI (3), pages 465-472, 2010.
89. H. Rivaz, H. Kang, P. Stolka, G. Hager, and E. Boctor. Novel reconstruction and feature exploitation techniques for sensorless freehand 3d ultrasound. In SPIE Med. Imag., pages 76291D1-76291D9, 2010.
90. H. Rivaz, A. Kapoor, I Fleming, G. Hager, and E. Boctor. A novel method for monitoring liver ablation using ultrasound elastography. In SPIE Med. Imag., pages 7629131-7629138, 2010.
91. Nishikant Deshmukh, Hassan Rivaz, Philipp J. Stolka, Hyun-Jae Kang, Gregory D. Hager, Mohamad E. Alaf, and Emad M. Boctor. Real-time gpu-based analytic minimization/dynamic programming elastography. In HP-MICCAI, 2010.
92. NP Deshmukh, H Rivaz, PJ Stolka, H Kang, GD Hager, ME Alaf, and EM Boctor. Real-time graphics processing unit-based ultrasound elastography. In Proceedings of the Ninth International Conference on the Ultrasonic Measurement and Imaging of Tissue Elasticity, 2010.
93. H Rivaz, U Hamper, M Choti, GD Hager, and EM Boctor. Monitoring ablative therapy using ultrasound elastography: Clinical results. In Proceedings of the Ninth International Conference on the Ultrasonic Measurement and Imaging of Tissue Elasticity, 2010.
94. H Rivaz, EM Boctor, and GD Hager. Robust real-time regularized ultrasound elastography. In Proceedings of the Ninth International Conference on the Ultrasonic Measurement and Imaging of Tissue Elasticity, 2010.
95. H. Girgis, T. Dassopoulos, G. E. Mullin, R. Kumar, and G. Hager. Computer automated severity assessment of crohn's disease (cd) lesions in wireless capsule endoscopy (ce) images, 2010. Digestive Disease Week (poster).
96. Hani Girgis, Benjamin Mitchell, Themistocles Dassopoulos, Gerard Mullin, and Gregory Hager. An intelligent system to detect crohn's disease inflammation in wireless capsule endoscopy videos. In Proceedings of ISBI, 2010.
97. P. Rajan, M. Canto, E. Gorospe, A. Almario, A. Kage, Ch. Winter, G. Hager, Th. Wittenberg, and Ch. Mzenmayer. Automated diagnosis of barrett's esophagus with endoscopic images. In World Congress on Medical Physics & Biomedical Engineering 2009, pages 2189-2192. Springer, September 2009.
98. Hassan Rivaz, Pezhman Foroughi, Ioana Fleming, Richard Zellars, Emad Boctor, and Gregory D. Hager. Tracked regularized ultrasound elastography for targeting breast radiotherapy. In Medical Image Computing and Computer Assisted Intervention (MICCAI), pages 507-515, September 2009.
99. Zachary Pezzementi, Sandrine Voros, and Gregory D. Hager. Articulated Object Tracking by Rendering Consistent Appearance Parts. In International Conference on Robotics and Automation (ICRA), pages 1225-1232, May 2009.

100. Srdan Bejakovic, Rajesh Kumar, Themistocles Dassopoulos, Gerard Mullin, and Gregory Hager. Analysis of Crohn's Disease Lesions in Capsule Endoscopy Images. In International Conference on Robotics and Automation (ICRA), May 2009.
101. Brian Becker, Sandrine Voros, and Gregory D. Hager. Active guidance of a handheld micromanipulator using visual servoing. In International Conference on Robotics and Automation (ICRA), May 2009.
102. P. Foroughi, C. Csoma, H. Rivaz, G. Fichtinger, R. Zellars, G. D. Hager, and E. Boctor. Multi-modality fusion of CT, 3D ultrasound, and tracked strain images for breast irradiation planning. In SPIE medical imaging: Ultrasonic Imaging and Signal Processing, volume 7265, page 72651B, 2009.
103. P. Foroughi, G. D. Hager, and E. Boctor. Robust elasticity imaging using external tracker. In IEEE International Symposium on Biomedical Imaging: from Nano to Macro, pages 209-212, 2009.
104. Balakrishnan Varadarajan, Carol E. Reiley, Henry Lin, Sanjeev Khudanpur, and Gregory Hager. Data-derived models for segmentation with application to surgical assessment and training. Medical Image Computing and Computer-Assisted Intervention -MICCAI 2009, pages 426-434, 2009.
105. Carol E. Reiley and Gregory D. Hager. Task versus subtask surgical skill evaluation of robotic minimally invasive surgery. Medical Image Computing and Computer-Assisted Intervention -MICCAI 2009, pages 435-442, 2009.
106. Daniel Mirota, Hanzi Wang, Russell H. Taylor, Masaru Ishii, and Gregory D. Hager. Toward video-based navigation for endoscopic endonasal skull base surgery. In Guang-Zhong Yang, David Hawkes, Daniel Rueckert, Alison Noble, and Chris Taylor, editors, Medical Image Computing and Computer-Assisted Intervention - MICCAI 2009, volume 5761 of Lecture Notes in Computer Science, pages 91-99. Springer, 2009.
107. Rizwan Chaudhry, Avinash Ravichandran, Gregory D. Hager, and Ren Vidal. Histograms of oriented optical flow and binet-cauchy kernels on nonlinear dynamical systems for the recognition of human actions. In CVPR, pages 1932-1939, 2009.
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245. Explaining Modal Logic Proofs (with A. Felty). In *Proceedings of IEEE Systems, Man, and Cybernetics Conference on Human Computer Interaction*, 1988.
246. Searching for Information (with M. Mintz). In *Proceedings of Workshop on Spatial Reasoning and Multi-Sensor Fusion*, pp. 313–322, Morgan Kaufmann, 1987.
247. Tactile Information Processing— The Bottom Up Approach (with R. Bajcsy). In *Proceedings of the International Conference on Pattern Recognition* pp. 809-811, 1984.

Other Conferences and Workshops:

248. Helmuth Radrich, Nicolas Padoy, Ahmad Ahmadi, Hubertus Feussner, Greg Hager, Darius Burschka, and Alois Knoll. Synchronized multimodal recording system for laparoscopic minimally invasive surgeries. In MICCAI-2009 Workshop on Modeling and Monitoring of Computer Assisted Interventions (M2CAI), September 2009.
249. T. Dassopoulos, R. Kumar, S. Bejakovic, P. Rajan, S. Seshamani, G. Mullin, and G. Hager. Automated detection and assessment of crohn’s disease lesions in images from wireless capsule endoscopy. In Digestive Disease Week 2009.

- 250. R. Sznitman, H. Lin, M. Gupta, and G. D. Hager. Active Background Modeling: Actors on a Stage. In Proc. International Conference on Computer Vision, Workshop on Visual Surveillance, 2009.
- 251. Tracker fusion for robustness in visual feature tracking (with K. Toyama). In *SPIE Int'l Sym. Intel. Sys. and Adv. Manufacturing*, volume 2589, Philadelphia, PA, October 1995.
- 252. Towards task-directed planning of cooperating sensors (with G. Grunwald). In *SPIE Sensor Fusion V*, pages 214-225, Nov., 1992.
- 253. A constraint-based view of selective perception. In *AAAI Spring Symposium on Selective Perception*, pp. 61-65, 1992.
- 254. Set-based estimation: Towards task-directed sensing. In *Proceedings of Melecon Conference*, pp. 1205-1209, 1991.
- 255. Deciding not to decide using resource-bounded sensing. In *Proceedings of the Symposium on Advances in Intelligent Systems*, SPIE, Boston, MA, 1990.

Other Publications:

- 256. Jason J. Corso, Maneesh Dewan, and Gregory D. Hager. Image Segmentation Through Energy Minimization Based Subspace Fusion. Technical Report CIRL-TR-04-01, The Johns Hopkins University, 2004.
- 257. Guangqi Ye, Jason J. Corso, Gregory D. Hager, and Allison M. Okamura. Augmented Reality Combining Haptics and Vision. Technical Report 03, The Johns Hopkins University, 2003. CIRL Technical Report.
- 258. Jason J. Corso, Nicholas Ramey, and Gregory D. Hager. Stereo-Based Direct Surface Tracking with Deformable Parametric Models. Technical Report 02, The Johns Hopkins University, 2003. CIRL Technical Report.
- 259. Le Lu, Xiangtian Dai, and Gregory D. Hager. Real Time Video Mosaicing - Technical Report. Technical report, The Johns Hopkins University, 2003. CIRL Technical Report.
- 260. Myron Z. Brown, Darius Burschka, and Gregory D. Hager. Shape and appearance in object recognition. 2003.
- 261. Tracking Objects by Color Alone (with Christopher Rasmussen), DCS-RR-1114, Yale University, New Haven, CT, 1997.
- 262. Tracking Tools for Vision-Based Navigation, DCS-RR-1060, Yale University, New Haven, CT, 1994.
- 263. Six DOF Visual Control of Relative Position, DCS-RR-1038, Yale University, New Haven, CT, 1994
- 264. A Framework for Real-Time Vision-Based Tracking Using Off-the-Shelf Hardware (with S. Puri and K. Toyama), DCS-RR-988, Yale University, New Haven, CT, 1993.
- 265. A C++ Interval and Constraint Solving Package, DCS-RR-953, Yale University, New Haven, CT, 1993.
- 266. Some Problems in Adaptive Visual Servoing, DCS-RR-948, Yale University, New Haven, CT, 1993.
- 267. Active Reduction of Uncertainty in Multi-Sensor Systems. Ph.D. thesis, University of Pennsylvania, 1988.

268. An Agent Specification Language, MS-CIS-87-08, The University of Pennsylvania, Philadelphia, PA, 1987.
269. Information Maps for Active Sensor Control, MS-CIS-87-07, The University of Pennsylvania, Philadelphia, PA, 1987.
270. Commonsense Summer: The Final Report (with J. Hobbs *et al.*), CSLI-85-35, SRI International, Palo Alto, CA, 1985.
271. Computational aspects of proof theory in modal logic. Masters thesis, University of Pennsylvania, 1985

Software Packages:

1. The XVision Tracking Toolkit, 1995, 1996, 1997.
2. A System for Solution of High-Dimensional Nonlinear Constraints, 1993.

Patents and Patent Applications

1. G. Hager, C. Reiley, B. Varadarajan, S. Khudanpur, H. Lin, R. Kumar, Method and System for Quantifying Technical Skill, US Patent Application 2010/028025.
2. H. Rivaz, E. Boctor, G. Fichtinger, G. Hager, Robust and Accurate Freehand 3D Ultrasound. US Patent Application 2010/0198068.
3. G. Hager and B. Wegbreit. System and method for constructing a 3D scene model from an image. US Patent Application 2010/0085358.
4. E. Boctor, G. Fichtinger, G. Hager, and H. Rivaz. Apparatus and Methods for Computing 3D Ultrasound Elasticity Images. US Patent Application 2008/0306384.
5. E. Boctor, G. Hager, G. Fichtinger, and A. Viswanathan. Ultrasound Calibration and Real-Time Quality Assurance Based on Closed Form Formulation US Patent Application 2008/0269604.
6. G. Hager and E. Wegbreit. System and method for recognition in 2D images using 3D class models US Patent Application 2006/0285755.
7. G. Hager and E. Wegbreit. System and method for computing grasps for a robotic hand with a palm US Patent Application 2006/0012198.
8. G. Hager and E. Wegbreit. System and method for 3D object recognition using range and intensity, 2005. USPTO Publication 2005/0286767 A1, Abandoned.
9. G. Hager and E. Wegbreit. Acquisition of three-dimensional images by an active stereo technique using locally unique pattern, US Patent 7103212, issued September, 2006.
10. A Vision-based Six-degree-of-freedom Computer Input Device (with K. Toyama), U.S. Patent 5889505 issued November, 1998.
11. Method and System for Cooperative Control of Manipulator Systems, (with R. Kumar, R. Taylor, A. Barnes and P. Jensen), preliminary patent filed, 2001, Abandoned.
12. Method for Robot Assisted Puncture of a Blood Vessel, (with R. Kumar, R. Taylor, A. Barnes and P. Jensen and E. deJuan), preliminary patent filed, 2001, Abandoned.

13. Method for Creating High Resolution Composite Images, (with R. Kumar, R. Taylor, A. Barnes and P. Jensen), preliminary patent filed, 2001, Abandoned.
14. Method for Manipulating Cells of a Cell Culture (with R. Kumar and R. Taylor), preliminary patent filed, 2001, Abandoned.

TEACHING and MENTORING:

Postdoctoral Students:

Rogério Richa, 2011-present.
Nicolas Padoy, 2010-present.
Eric Meisner, 2009-present.
Hani Girgis, 2009-2010 (now Research Scientist, NIH)
Erion Plaku, 2008-2010 (now Assistant Professor, Catholic University)
Sandrine Voros, 2007-2009 (now Assistant Professor, University of Grenoble)
Hanzi Wang, 2006-2008 (now Professor, Xaimen University)
Danica Kragic, 2002 (now Professor, KTH Sweden)
Darius Burschka, 1999-2005 (now Associate Professor, TU Munich)
Martin Jägersand, 1998-2000 (now Associate Professor, University of Alberta)
Eric Marchand, 1996-1997 (now Senior Researcher, INRIA Rennes)
Markus Vincze, 1996 (now Professor, TU Vienna)

Thesis Students:

Haluk Tokgozoglu, Ph.D. expected 2015.
Narges Ahmidi, Ph.D. expected 2014.
Kelleher Guerin, Ph.D. expected 2013.
Purnima Rajan, Ph.D. expected 2013.
Ioana Fleming, Ph.D. expected 2012.
Daniel Mirota, Ph.D. expected 2012.
Pezhman Foroughi, Ph.D. expected 2011.
Carol Reiley, Ph.D. expected 2011.
Danel Abretske, withdrew.
Raphael Sznitman, Ph.D. 2011, (now postdoc, EPFL).
Zachary Pezzementi, Ph.D. 2011 (now Research Scientist, CMU).
Sharmishta Seshamani, Ph.D. 2011 (now postdoc, University of Washington).
Hassan Rivaz, Ph.D. 2010 (now postdoc, McGill)
Henry Lin, Ph.D. 2009 (now Senior Engineer, Intuitive Surgical)
Tiffany Chen, MSE, 2008 (now grad student, Georgia Tech)
Maneesh Dewan, Ph.D. 2007 (now at Siemens Healthcare Solutions)
Le Lu, Ph.D. 2007 (now at Siemens Central Research)

Guangqi Yeh, Ph.D. 2005 (now at Google)
Jason Corso, Ph.D. 2005 (now Assistant Prof., University of Buffalo)
Xangtian Dai, Ph.D. 2005 (now at Google)
Izzet Pembeci, Ph.D. 2003 (unknown)
Nicholas Ramey, M.S.E 2003 (now in residency at Duke)
Samuel Lange, M.S.E, 2002 (unknown)
Zachary Dodds, Ph.D. 2000 (now Associate Professor, Harvey Mudd)
Christopher Rasmussen, Ph.D. 2000 (now Associate Professor, University of Delaware)
Aage Bendiksen, M.S. degree received 1995 (unknown)
Jesse Reklaw, M.S. received 1998 (unknown)
Kentaro Toyama, Ph.D received 1997 (former Vice President, Microsoft Research India; now at UC Berkeley)
Jonathan Wang, M.S. degree received 1996 (unknown)
Sami Atiya, Ph.D. received 1995 (now high-level Siemens Management)

Listed Courses Taught or Co-Taught:

Algorithms for Sensor-based Robotics, 2006, 2009.
Data Structures, 2005, 2007, 2010, 2011.
Vision-Based Interaction in Man and Machine, 2000
Computer Vision, 1991 - present.
Artificial Intelligence, 1992-1993, 1996, 1997, 1999, 2000.
Analytical Introduction to Engineering Issues in Robotics (new course), 1994-1999.
Autonomous Systems (new course), 1993, 1995, 1997, 1999.
A Second Course in Programming (new course), 1993, 1994, 1997.
Programming in Fortran, 1992-1993.

Seminar Courses:

Topics in Intelligent Autonomous Systems, 1992
Topics in Sensing for Artificial Intelligence and Robotics Applications, 1991

GRANTS

Awarded:

1. NSF: "International: A US-Germany Research Collaboration on Systems for Computer-Integrated Healthcare" for 147,320 from April 6, 2011-April 5, 2014.
2. NIH SBIR "Precisely Shaped Acoustic Ablation of Tumors under 3D Ultrasound Image Guidance" (Burdette, PI) for 1,022,500 (total) July 1 2008 to June 30, 2013.

3. NIH: Automated Assessment of the Effects of System Limitations Based Upon Data Collected from Multiple Training Centers (Kumar PI), for 439,116 from July 1 2009 to June 30 2011.
4. NSF: "CPS: Medium: Hybrid Systems for Modeling and Teaching the Language of Surgery " for 1,499,828 from July 1, 2009 to June 30, 2012.
5. NSF: "CDI Type-II: Language Models for Human Dexterity" for 1,685,877 July 1, 2009 to June 30, 2013.
6. NIH: "A Microsurgical Assistant System" (R. Taylor PI), for 5,500,000 from July 1, 2008-June 30, 2013.
7. NIH: "Quantitative Endoscopic Measurement of Anatomy Video," (G. Hager, PI with M. Ishii), for 440,512 from July 1, 2008 to June 30, 2010.
8. NIH: "Toward Quantitative Disease Assessment from Capsule Endoscopy Images," (G. Hager, PI with T. Dassopoulos), for 421,909 from July 1, 2007 to June 30, 2009.
9. Army/GDRS: "Recognition of Individual and Group Activities in Video," for 121, 943 from July 24, 2008-Feb. 23, 2009.
10. TATRC: "Context Aware Surgical Assistance for Virtual Mentoring,"(G. Hager (PI), R. Taylor) for 155,216 from January 31, 2006 to May 29, 2007.
11. NSF: "Structure Induction for manipulative and Interactive Tasks," (G. Hager, PI and S. Khudanpur), 480,000 from February 01, 2006 to January 31, 2009.
12. WSE/APL; "Vision-Aided Guidance, Navigation and Control of Small Unmanned Aerial Vehicles," for 50,000 from September 01, 2005 - August 31, 2007.
13. NSF: "Manipulating and Perceiving Simultaneously (MAPS)," for 200,000 from Oct, 1. 2007-Sept. 30, 2009.
14. Paul Maritz Fund: "Learning to See: Structures for Data-Driven Computational Vision on a Massive Scale," for 90,000 from February 01, 2006 - January 31, 2008.
15. NIH: "Direct Video-CT Registration for High Precision Endoscopic Interventions," (G. Hager, PI, M. Ishii and R. Taylor), for 440,348 from April 01, 2006 to March 30, 2008.
16. NSF: "A Flexible "Human-in-the-Loop" Microsystem Assembly Platform, (Phase I SBIR with Invenios, Inc) for 30000 from January, 2004 - July 01, 2004.
17. NIH: "Tracking and Mosaicking in the Endometrium,"(Phase I SBIR with Infinite Biomedical Tech. Inc.), for 72,000 from January 26, 2005 - July 26, 2005.
18. NSF: "ITR:Modeling, Synthesis and Analysis of Human-Machine Collaborative Systems," (G. Hager (PI), A. Okamura, R. Taylor and B. Hannaford) for 1,100,000 from 8/1/02-7/31/07.
19. NSF: "ITR/SY:Software Systems for Vision-based Spatial Interaction," for 450,000 from 8/1/01-7/31/04.
20. NSF: "ERC PER: A Quantitive Eye Atlas," (G. Hager (PI), B. Roysam (RPI)) for 150,000 from 8/1/01-7/31/03.
21. NSF: "Scale-Invariant Skill Augmentation for cooperative Human-Machine Micromanipulation Systems,"(G. Hager (PI), A. Okamura and R. Taylor) for 380,000 from 8/1/01-7/31/04.

22. DARPA: “Composition and Adaptation of Goal-Oriented Robotic Systems” (G. Hager (PI), P. Hudak and D. McDermott) for \$2,304,083 from 4/1/00-4/1/04.
23. DARPA: “Environment-Independent Perception and Navigation for Tactical Mobile Robots: A Diktiometric Approach” (G. Hager (PI), D. Kriegman and D. McDermott) for \$750,000 from 6/98-6/00.
24. NSF: “A Compositional Approach to Vision-Based Manipulation” (G. Hager (PI) and M. Jägersand) for \$66,000 from 6/98-6/00 (CISE Postdoctoral Research Award)
25. ARO: “Visual Tracking as Stabilization” (G. Hager (PI) and D. Kriegman) for \$270,000 from 3/1/98-3/1/01.
26. ARO: “Next Generation Vision-Based Control Systems” (G. Hager (PI), A.S. Morse and D. Kriegman) for \$129,945 from 3/1/97-3/1/98 (DURIP equipment grant).
27. NSF: “Domain-Independent Vision-Based Navigation” (D. Kriegman (PI) and G. Hager) for \$419,184 from 9/1/97–10/31/00 .
28. NSF: “The Block Island Workshop on Vision and Control” (G. Hager, PI) for \$14,500 from 6/1/97–5/30/98.
29. NSF: “ A Modular Toolkit for Vision and Robotics – An Experiment in Domain-Specific Software Architectures” (G. Hager (PI) and P. Hudak) for \$1,223,090 over 4 years from 6/1/97-6/1/01.
30. DARPA: “Point-Man Robot” (STTR subcontract through Nomadics Inc.) for \$45,000, over 1 year from 6/1/97 - 6/1/98.
31. Siemens Corp: “Light-Weight Vision for Enhanced Mobility” (G. Hager, PI)for \$40,000, over 1 year from 1/1/97 - 9/30/97.
32. NSF: “Calibration Insensitive Hand-Eye Coordination for Robotic Systems Based on Stereo Vision” (G. Hager, PI) for \$240,000 over 3 years from 8/95-8/98.
33. DARPA: “Equipment for Sensor-Based Navigation and Control of Autonomous Agents” (D. McDermott (PI) and G. Hager) for \$75,000 from 1/23/95–1/23/96.
34. DARPA: “Sensor-based and Geometry-based Planning for Autonomous Agents” (with D. McDermott (PI) and G. Hager) for \$971,489 from 10/1/93–5/31/96.
35. NSF: “Resource-Bounded Sensor-Based Decision Making in Unconstrained Environments” (G. Hager, PI) for \$170,245 from 9/1/91–2/28/94
36. NSF: “A Range Finder & Manipulator for Empirical Verification of Sensor-Based Decision Making” (D. Kriegman (PI) and G. Hager) for \$40,000 from 5/1/91–2/28/93 .
37. NATO: “NATO Collaborative Research Grant Between Yale University and the DLR” (G. Hirzinger, PI) for \$5000 from 9/1/92—9/1/94.
38. NATO: “NATO Collaborative Research Grant Between Yale University and the DLR” (G. Hirzinger, PI) for \$5000 from 9/1/91—9/1/92.