1. Education

Ph.D. in Electrical and Computer Engineering, Carnegie Mellon University, Pittsburgh, USA, December 1996. Thesis: "Dynamics and control of underactuated manipulators."

M.Sc. in Electrical Engineering, University of São Paulo, São Paulo, Brazil, July 1992. Thesis: "Robust position control of mechanical manipulators."

B.Sc. in Electrical Engineering, University of São Paulo, São Paulo, Brazil, December, 1990. Senior Project: "Fuzzy control of servomechanisms."

2. Research Interests

- Robotic systems for agricultural and environmental applications
- Guidance, navigation, and control technologies for autonomous aerial systems.
- Human-robot interfaces.
- K-12 robotics education.
- Technological innovation, innovation management, strategic planning.

3. Professional Experience

Since 06/2005: Robotics Institute, Carnegie Mellon University, Pittsburgh, PA, USA

Systems Scientist, since 09/2007

- Project manager for SafeTX: Situational Awareness, Collision Avoidance & Intuitive Control for Roadable Air Vehicles, funded by DARPA. Total funding: $988,000. Period of performance: Oct. 2010 to Feb. 2012.
- Project manager for Comprehensive Automation for Specialty Crops, funded by the USDA Specialty Crops Research Initiative. Total funding: $12 million. Period of performance: Sep. 2008 to Aug. 2012.

Project Scientist, Autonomous Helicopter Laboratory, 12/2005 – 08/2007

- Responsible for dynamic modeling and control methodologies for unmanned helicopters.
- Responsible for project management and interaction with government agencies.
- Co-responsible for procuring new funding sources and preparing proposals to funding agencies.
- Co-responsible for technical documentation, including conference and journal articles.

Project Scientist, Tele-Supervised Autonomous Robotics Laboratory, 06/2005 – 12/2005

- Co-responsible for system-level project leadership, focused on the definition of a general and widely applicable architecture for human supervision of a fleet of autonomous robots in support of sustained, affordable, and safe space exploration.
- Co-responsible for project management, including timely achievement of project schedules and completion of deliverables.
- Responsible for Earned-Value Management reporting to the project sponsor, including all technical and financial reports.
- Co-responsible for procuring new funding sources and preparing proposals to funding and government agencies.
- Co-responsible for technical documentation, including conference and journal articles.
- Responsible for the creation and maintenance of a knowledge base for project data and documentation sharing, dissemination, and archival.
- Co-responsible for the relationship with the project's partner institution in California.

02/2001 to 06/2005: Genius Institute of Technology, Manaus, Brazil.

Innovation Manager, 04/2005 - 06/2005

Knowledge Management and Institutional Relations Program Leader, 01/2003 - 03/2005

Technology Management and Development Program Leader, 02/2001 - 12/2002

- Co-responsible for structuring the institute's technology and innovation area and performing the institute's strategic planning and budgeting.
- Co-responsible for technology analysis and forecast based on technical literature and market surveys. Technologies addressed target the multimedia, consumer electronics, and communication markets, specially audio and video compression, digital transmission systems, digital television, and speech recognition.
- Responsible for structuring and operating the funding, intellectual property, and information systems areas of the institute, including the coordination of all submissions to funding agencies.
- Responsible for the official accreditation of the institute at the Brazilian Ministry of Science and Technology and the Ministry of Development, Industry, and External Commerce.
- Co-responsible for the elaboration, submission, and successful approval by federal funding agencies of R&D grants totaling more than US$ 10 million.
- Co-responsible for the institute's focus area in Digital Terrestrial Television and negotiations with government agencies and technology partners. Responsible for the elaboration, submission, and successful approval by the federal government of a priority program on Digital Television at the Amazon region.
- Responsible for the elaboration of technical and economical feasibility studies for external clients.
- Responsible for leading the creation and accreditation of the only Computer Science M.Sc. program in Brazil's northern region, at the Federal University of Amazonas. Responsible for the establishment of R&D cooperation projects with leading Brazilian universities.
- Co-organizer of the "Workshop on the Global Integrated Circuit Design Market" for the Ministry of Science and Technology.
- Official presenter of the institute for clients and authorities visiting the site and for presentations made at client and government offices and external events.

02/2000 to 12/2000: Paulista University, Campinas, SP, Brazil

Lecturer, responsible for the courses Servomechanisms and Robotics and Control Systems and Automation.

02/1997 to 01/2001: National Technology Information Institute, Campinas, SP, Brazil

Laboratory Head, 2000 - 2001, Robotics and Computer Vision Laboratory

Associate Researcher, 1997 - 1999, Robotics and Computer Vision Laboratory

Director's Core Staff, 1997 – 2001.

- Principal investigator of projects Semi-Autonomous Robotic Vehicles, AURORA (Autonomous Unmanned Remote Monitoring Robotic Airship), and REAL (Remotely Accessible Laboratories), funded at US$ 570k by the Brazilian government.
- Co-responsible for the yearly strategic technology planning and budget planning for the Institute.
- Advisor of undergraduate and graduate students at the Universities of São Paulo and Campinas.

08/1992 to 12/1996: Space Robotics Laboratory, Carnegie Mellon University, Pittsburgh, PA, USA.

Research Assistant to Dr. Yangsheng Xu.

01/1991 to 07/1992: Department of Electrical Engineering, University of São Paulo, São Paulo, Brazil.

Lecturer, responsible for the courses Control Systems Laboratory, Automation Laboratory, and Industrial Processes Control.

4. Publications

Books in Preparation

Siqueira, A.A.G; Terra, M.H.; Bergerman, M. *H_∞ Control of Robot Manipulators*. Springer-Verlag. Expected to be published in 2011.

Books Edited

Passos, C.A.S.; Silva Filho, O.S.; Bergerman, M. *Annals of the II Scientific Initiation Journey of the National Technology Information Institute*. ITI, Campinas, SP, Brazil, November, 2000. (in Portuguese)

Chapters in Books

Bergerman, M.; Kang, T.C.; Carvalho, J.R.H.; Silva Jr., B.I.; Guimarães, R.; Valenzuela, H. "Bringing Amazon to the innovation world through technological incubation." *The Future of the Amazon*, Alex Fiúza de Mello (ed.), Federal University of Pará Publishing Co., Belém, PA, Brazil, pp. 155-169, 2002.

Elfes, A.; Bueno, S.S.; Ramos, J.J.G.; Paiva, E.C.; Bergerman, M.; Carvalho, J.R.H.; Maeta, S.M.; Mirisola, L.G.B.; Faria, B.G.; Azinheira, J.R. "Modelling, control and perception for an autonomous robotic airship." *Lecture Notes in Computer Science Vol. 2238: Sensor-Based Intelligent Robots*, Christensen, H.I. and Hager, G.D. (eds.), Springer-Verlag, New York, 2002, pp. 216-244. (Invited article at the Dagstuhl 2000 International Seminar on Modelling of Sensor-Based Intelligent Robot Systems, Schloss Dagstuhl, Germany.)

Elfes, A.; Carvalho, J.R.H.; Bergerman, M.; Bueno, S.S. "Toward a perception and sensor fusion architecture for a robotic airship." *Sensor Fusion and Decentralized Control in Robotic Systems* IV, Gerard T McKee, Paul S. Schenker (eds.), Proceedings of SPIE vol. 4571, pp. 65-74, October 2001.

Terra, M.H.; Mendes, R.A.; Bergerman, M. "Fault detection and isolation for mechanical manipulators via Luenberger observers." *Robot Control* 2000 (*Proceedings of the 6th International IFAC Symposium on Robot Control*), Kopacek, P. (ed.), Pergamon, July 2001.

Bergerman, M.; Terra, M.H.; Tinós, R.; Siqueira, A.A.G.; Xu, Y.; Sun, L.W. "Fault tolerant control of mechanical manipulators: a hybrid systems approach." *Robot Control* 2000 (*Proceedings of the 6th International IFAC Symposium on Robot Control*), Kopacek, P. (ed.), Pergamon, July 2001.

Elfes, A.; Bergerman, M.; Carvalho, J. R. H. "Dynamic target identification by an aerial robotic vehicle." *Dynamische Perzeption*, Baratoff, G. and Neumann, H. (eds.), AKA, Berlin, September 2000.

Bergerman, M.; Terra, M.H.; Xu, Y. "Position control of underactuated manipulators: a state-of-the-art review and the road ahead." *International Symposium on History of Machines and Mechanisms - Proceedings* HMM 2000, Marco Ceccarelli (ed.), Kluwer Academic Publishers, Dordrecht, April 2000, pp. 361-369.

Refereed Journal Articles

S. Singh, M. Bergerman, J. Cannons, B. Grocholsky, B. Hamner, G. Holguin, L. Hull, V. Jones, G. Kantor, H. Koselka, G. Li, J. Owen, J. Park, W. Shi, J. Teza. "Comprehensive Automation for Specialty Crops: Year 1 Results and Lessons Learned." *Journal of Intelligent Service Robotics*, Special Issue on Agricultural Robotics, vol. 3, no. 4, pp. 245-262, October 2010.

Singh, S.; Baugher, T.; Bergerman, M.; Grocholsky, B.; Harper, J.; Hoheisel, G.; Hull, L.; Jones, V.; Kantor, G.; Koselka, H.; Lewis, K.; Messner, W.; Ngugi, H.; Owen, J.; Park, J.; Seavert, C. "Automation for specialty crops: a comprehensive strategy, current results, and future goals." *HortScience*, vol. 44, no. 4, July 2009, pp. 1109-1110. (Abstract only)

Tinós, R.; Terra, M.H.; Bergerman, M; "A fault tolerance framework for cooperative robotic manipulators." *Control Engineering Practice*, vol. 15, n. 5, May 2007, pp. 615-625.

Maciel, B. C. O.; Terra, M. H.; Bergerman, M. "Optimal robust control of underactuated manipulators via actuation redundancy." *Journal of Robotic Systems*, vol. 20, n. 11, November 2003, pp. 635-648.

Elfes, A.; Bueno, S. S.; Bergerman, M.; de Paiva, E.C.; Ramos, J.G.; Azinheira, J.R. "Robotic airships for exploration of planetary bodies with an atmosphere: Autonomy challenges." *Autonomous Robots*, vol. 14, n. 2-3, March-May 2003, pp. 147-164.

Guimarães, E.; Maffeis, A.T.; Pinto, R.; Miglinski, C.; Cardozo, E.; Bergerman, M.; Magalhães, M. "REAL - an Internet-accessible mobile robot laboratory." IEEE *Proceedings*, Special Issue on Networked Intelligent Robots Through the Internet, vol. 91, n. 3, March 2003, pp. 440-448. (Invited article)

Ramos, J.J.G.; Maeta, S.M.; Mirisola, L.G.B; Bueno, S.S.; Bergerman, M.; Faria, B.G.; Pinto, G.E.; Bruciapaglia, A.H. "Internet-based solutions in the development and operation of an unmanned robotic airship." IEEE *Proceedings*, Special Issue on Networked Intelligent Robots Through the Internet, vol. 91, n. 3, March 2003, pp. 463-474. (Invited article)

Guimarães, E.; Maffeis, A.T.; Pereira, J.; Russo, B.; Cardozo, E.; Bergerman, M.; Magalhães, M. "REAL: a virtual laboratory for mobile robot experiments." IEEE *Transactions on Education*, vol. 46, n. 1, February 2003, pp. 37-42.

Azinheira, J.R.; E.C. Paiva; J.R.H. Carvalho; J.J.G. Ramos; S.S. Bueno; M. Bergerman; Ferreira, P.A.V. "Lateral/directional control for an autonomous, unmanned airship." *Aircraft Engineering and Aerospace Technology*, vol. 73, n. 5, 2001, pp. 453-458.

Terra, M.H.; Bergerman, M.; Tinós, R.; Siqueira, A.A.G. "Fault tolerant control of robotic manipulators." *Control and Automation*, vol. 12, n. 2, May-August 2001, pp. 73-92.

Bergerman, M.; Kim, J.-H.; Campos, M.F.M.; Verner, I. "The FIRA 1999 Championship." *Robotics and Autonomous Systems*, vol. 32, n. 4, September 2000, pp. 253-257.

Bueno, S.S.; Ramos, J.J.G; Bergerman, M.; Paiva, E.C; Azinheira, J.R; Maeta, S.M.; Mirisola, L.G.B.; Faria, B.G.; Elfes, A. "An unmanned airship for aerial robotic inspection." *Robotics*, n. 39, April 2000, pp. 8-10.

Liu, Y.-H.; Xu, Y.; Bergerman, M. "Cooperation control of multiple manipulators with passive joints." IEEE *Transactions on Robotics and Automation*, vol. 15, n. 2, April 1999, pp. 258-267.

Queiroz, L.R.; Bergerman, M.; Machado, R.C.; Bueno, S.S.; Elfes, A. "Distance learning in robotics and computer vision." *Brazilian Journal on Informatics and Education*, n. 3, September 1998, pp. 17-26. (Invited article)

Elfes, A.; Bueno, S.S.; Bergerman, M.; Ramos, J.J.G.; Gomes, S.B.V. "Project AURORA: Development of an autonomous unmanned remote monitoring robotic airship." *Journal of the Brazilian Computer Society*, n. 3, vol. 4, April 1998, pp. 70-78.

Liang, B.; Xu, Y.; Bergerman, M. "Mapping a space manipulator to a dynamically equivalent manipulator." *Transactions of the* ASME, *Journal of Dynamic Systems, Measurement, and Control*, vol. 120, n. 1, March 1998, pp. 1-7.

Bergerman, M.; Xu, Y. "Optimal control of manipulators with any number of passive joints." *Journal of Robotic Systems*, vol. 15, n. 3, March 1998, pp. 115-130.

Bergerman, M.; Xu, Y. "Robust joint and Cartesian control of underactuated manipulators." *Transactions of the* ASME, *Journal of Dynamic Systems, Measurement, and Control*, vol. 118, n. 3, September 1996, pp. 557-565.

Bergerman, M.; Lee, C.; Xu, Y. "A dynamic coupling index for underactuated manipulators." *Journal of Robotic Systems*, vol. 12, n. 10, October 1995, pp. 693-707.

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Singh, S.; Baugher, T.; Bergerman, M.; Grocholsky, B.; Harper, J.; Hoheisel, G.-A.; Hull, L.; Jones, V.; Kantor, G.; Koselka, H.; Lewis, K.; Messner, W.; Ngugi, H.; Owen, J.; Park, J.; Seavert, C. "Automation for Specialty Crops: A Comprehensive Strategy, Current Results, and Future Goals." 4th IFAC *International Workshop on Bio-Robotics, Information Technology, and Intelligent Control for Bioproduction Systems*, Champaign, IL, September 2009, paper #501.

Singh, S.; Baugher, T.; Bergerman, M.; Grocholsky, B.; Harper, J.; Hoheisel, G.-A.; Hull, L.; Jones, V.; Kantor, G.; Koselka, H.; Lewis, K.; Messner, W.; Ngugi, H.; Owen, J.; Park, J.; Seavert, C. "Automation for Specialty Crops: A Comprehensive Strategy, Current Results, and Future Goals." *2009 ASHS Annual Conference*, Poster Board #226.

Podnar, G.; Dolan, J.; Elfes, A.; Bergerman, M. "Multi-level autonomy robot telesupervision." Workshop on New Vistas and Challenges in Telerobotics, IEEE *International Conference on Robotics and Automation*, May 2008.

Bergerman, M.; Amidi, O.; Miller, J.R.; Vallidis, N.; Dudek, T. "Cascaded position and heading control of a robotic helicopter." IEEE/RSJ *International Conference on Intelligent Robots and Systems*, October-November 2007, pp. 135-140.

Podnar, G.; Dolan, J.; Elfes, A.; Bergerman, M. "Human telesupervision of very heterogeneous planetary robot teams." AIAA SPACE 2007 *Conference and Exposition*, Long Beach, California, September 2007, Paper AIAA2007-6165.

Elfes, A.; Dolan, J.M.; Podnar, G.; Mau, S.; Bergerman, M. "Safe and efficient robotic space exploration with tele-supervised autonomous robots." AAAI *Spring Symposium* 2006, Stanford, CA, USA, March 27-29, 2006, pp 104-113.

Halberstam, E.; Navarro-Serment, L.; Conescu, R.; Mau, S.; Podnar, G.; Guisewite, A.D.; Brown, H.B.; Elfes, A.; Dolan, J.M.; Bergerman, M. "A robot supervision architecture for safe and efficient space exploration and operation." 10th *Biennial International Conference on Engineering, Construction, and Operations in Challenging Environments*, Houston, TX, USA, March 5-8, 2006.

Podnar, G.; Dolan J.M.; Elfes, A.; Bergerman, M.; Brown, H.B.; Guisewite, A.D. "Human telesupervision of a fleet of autonomous robots for safe and efficient space exploration." 1st *Annual Conference on Human-Robot Interaction*, Salt Lake City, UT, USA, March 2-4, 2006, pp. 325-326.

Bergerman, M. "The role of innovation in wealth generation in Brazil: the example of the private technology innovation institutes." 3rd *National Conference on Science, Technology, and Innovation*, Brasília, DF, Brazil, March 2004, pp. 1333-1342. (Invited article)

Zandonai, D.; Bampi, S.; Bergerman, M. "A scalable hardware architecture for digital video motion estimation." IMAPS *International Technical Symposium on Packaging, Assembling and Testing & Exhibition*, Campinas, SP, Brazil, August 2003, pp. 144-149.

Zandonai, D.; Bampi, S.; Bergerman, M. "ME64 - A highly scalable hardware parallel architecture for motion estimation in FPGA." SBCCI *Brazilian Symposium on Integrated Circuits and Systems Design*, São Paulo, SP, 2003.

Bergerman, M.; Blay, E.; Carvalho, J.R.H.; Gonçalves, C.; Ritz, R.; Lima, E.E.; Bruno, L.F.C.; Kang, T.C.; Cunha, A.L. "Technology and innovation at Genius Institute of Technology." *International Conference of the Technology Research Institutes*, Porto Alegre, RS, Brazil, September 2002, pp 3-4.

Bergerman, M.; Blay, E.; Carvalho, J.R.H.; Gonçalves, C.; Ritz, R.; Lima, E.E.; Bruno, L.F.C.; Kang, T.C.; Cunha, A.L. "Technology and innovation at Genius Institute of Technology." *Annual Conference of the Brazilian Association of the Technology Research Institutes*, Curitiba, PR, Brazil, May 2002.

Tinós, R.; Terra, M.H.; Bergerman, M. "Fault tolerance in cooperative manipulators." IEEE *International Conference on Robotics and Automation*, Washington D.C., USA, May 2002.

Faria, B.G.; Maeta, S.M.; Ramos, J.J.G.; Bergerman, M.; Bueno, S.S. "A Controller Area Network fieldbus for an unmanned autonomous airship." XVI *Brazilian Conference on Mechanical Engineering*, Uberlândia, MG, Brazil, November 2001.

Peixoto, R.P.; Maeta, S.M.; Yamaguchi, H.; Saura, C.; Silva, J.V.L.; Faria, B.G.; Fujiwara, C.T.; Frazzato, R.R.; Ramos, J.G.; Bergerman, M.; Bueno, S.S. "Rapid prototyping-based development of mechanical parts for an unmanned robotic airship." XVI *Brazilian Conference on Mechanical Engineering*, Uberlândia, MG, Brazil, November 2001.

Elfes, A.; Bergerman, M.; Bueno, S.S. "The potential of robotic airships for planetary exploration." *International Conference on Advanced Robotics*, Budapest, Hungary, August 2001.

Carvalho, J.R.H.; Ferreira, P.A.V.; de Paiva, E.C.; Azinheira, J.R.; Ramos, J.G.; Bueno, S.S; Maeta, S.M.; Mirisola, L.G.B.; Faria, B.G.; Bergerman, M.; Elfes, A. "Application of classical and robust PI control to an unmanned robotic airship." 9th *International Symposium on Intelligent Robotic Systems*, Toulouse, France, July 2001.

Guimarães, E.G.; Maffeis, A.T.; Pereira, J.P.G.L.; Russo, B.G.; Bergerman, M.; Cardozo, E.; Magalhães, M. "REAL: A virtual laboratory for mobile robot experiments." IFAC *Conference on Telematics Applications in Automation and Robotics*, Weingarten, Germany, July 2001, pp. 209-214.

Azinheira, J.R.; de Paiva, E.C.; Ramos, J.G.; Bueno, S.S.; Bergerman, M. "Extended dynamic model for AURORA robotic airship." 14th AIAA *Lighter-Than-Air Technical Committee Convention and Exhibition*, Akron, OH, USA, July 2001.

Ramos, J.G.; de Paiva, E.C.; Carvalho, J.R.H.; Ferreira, P.A.V.; Azinheira, J.R.; Bueno, S.S; Maeta, S.M.; Mirisola, L.G.B.; Faria, B.G.; Bergerman, M.; Elfes, A. "Path tracking flight test of an autonomous unmanned robotic airship." 3rd *International Conference on Field and Service Robotics*, Otaniemi, Espoo, Finland, June 2001.

Maciel, B.C.O.; Bergerman, M.; Terra, M.H. "Optimal control of underactuated manipulators via actuation redundancy." IEEE *International Conference on Robotics and Automation*, Seoul, South Korea, May 2001, pp. 2114-2119.

Ramos, J.J.G.; Paiva, E.C.; Azinheira, J.R.; Bueno, S.S.; Maeta, S.M.; Mirisola, L.G.B.; Bergerman, M.; Faria, B.G. "Autonomous flight experiment with an unmanned robotic airship." IEEE *International Conference on Robotics and Automation*, Seoul, South Korea, May 2001, pp. 4152-4157.

Guimarães, E.G.; Maffeis, A.T.; Pereira, J.P.G.L.; Russo, B.G.; Bergerman, M.; Cardozo, E.; Magalhães, M. Miglinski, C.A.; Pinto, R.P. "Development of component-based software for new telecommunication services." 19th *Brazilian Symposium on Computer Networks*, Florianópolis, SC, Brazil, May 2001.

S.S. Bueno; M. Bergerman; J.J.G. Ramos; E.C. Paiva; J.R.H. Carvalho; A. Elfes; S.M. Maeta; L.G.B. Mirisola; B.G. Faria; C.S. Pereira. "Aerial robotics for environmental protection: a case study of autonomous airships." 7th *Brazilian Science Society Meeting*, Manaus, AM, Brazil, April 2001.

Faria, B.G.; Ramos, J.J.G.; Bergerman, M. "Evolution of Project AURORA's onboard sensorial system." VIII *Scientific Initiation Conference of the State University of Campinas*, Campinas, SP, Brazil, September 2000, pp. 44.

Pereira, J.P.G.L.; Guimarães, E.G.; Bergerman, M. "A graphical interface for multimedia flow management." VIII *Scientific Initiation Conference of the State University of Campinas*, Campinas, SP, Brazil, September 2000, pp. 144.

Maeta, S.M.; Ramos, J.J.G.; Mirisola, L.G.B.; Bueno, S.S.; Bergerman, M. "Project AURORA's hardware architecture." XIII *Brazilian Conference on Automation*, Florianópolis, SC, Brazil, September 2000, pp. 937-942.

Mirisola, L.G.B.; Ramos, J.J.G.; Maeta, S.M.; Bergerman, M.; Bueno, S.S. "A communication system for an unmanned robotic airship." XIII *Brazilian Conference on Automation*, Florianópolis, SC, Brazil, September 2000, pp. 943-948.

Tinós, R.; Terra, M.H.; Bergerman, M. "Neural networks-based fault detection and isolation for cooperative manipulators." XIII *Brazilian Conference on Automation*, Florianópolis, SC, Brazil, September 2000, pp. 1090-1095.

Terra, M.H.; Barbeiro, T.L.S.; Siqueira, A.A.G.; Bergerman, M. "Simulation environment for fault detection in underactuated manipulators via the stability radius approach." XIII *Brazilian Conference on Automation*, Florianópolis, SC, Brazil, September 2000, pp. 1353-1358.

Guimarães, E.G.; Cardozo, E.; Bergerman, M.; Magalhães, M. "An audio and video transmission framework for remotely accessible laboratories." XIII *Brazilian Conference on Automation*, Florianópolis, SC, Brazil, September 2000, pp. 925-930.

Terra, M.H.; Maciel, B.C.O.; Nakashima, P.H.R.; Bergerman, M. "State feedback linearization-based H2 and H-infinity control of an underactuated robotic manipulator." XIII *Brazilian Conference on Automation*, Florianópolis, SC, Brazil, September 2000, pp. 1102-1107.

Ramos, J.J.G.; Paiva, E.C.; Maeta, S.M.; Mirisola, L.G.B.; Azinheira, J.R.; Faria, B.G.; Bueno, S.S.; Bergerman, M.; Pereira, C.S.; Fujiwara, C.T.; Batistela, J.P.; Frazzato, R.R.; Peixoto, R.P.; Martins, G.C.; Elfes, A. "Project AURORA: A Status Report." 3rd *International Airship Convention and Exhibition*, Friedrichshafen, Germany, July 2000, Article B7.

Elfes, A.; Campos, M.F.M.; Bergerman, M.; Bueno, S.S.; Podnar, G.W. "A robotic unmanned aerial vehicle for environmental research and monitoring." 1st LBA *Scientific Conference*, Belém do Pará, PA, Brazil, June 2000, pp. 272.

Tinós, R.; Terra, M.H.; Bergerman, M. "A fault tolerance system for robotic manipulators with free- swinging joint failures." *Symposium on Fault Detection, Supervision, and Safety for Technical Processes* SAFEPROCESS 2000, Budapest, Hungary, June 2000, pp. 840-845.

Terra, M.H.; Maciel, B.C.O.; Nakashima, P.H.R.; Bergerman, M. "Underactuated manipulator robot control by state feedback linearization via H7." IFAC *Symposium on Robust Control Design*, Prague, Czech Republic, June 2000.

Guimarães, E.G.; Cardozo, E.; Bergerman, M.; Magalhães, M. "An audio and video transmission framework for new telecommunications services." 18th *Brazilian Symposium on Computer Networks*, Belo Horizonte, MG, Brazil, May 2000, pp. 505-518.

Elfes, A.; Bergerman, M.; Carvalho, J.R.H. "Towards dynamic target identification using optimal design of experiments." IEEE *International Conference on Robotics and Automation*, San Francisco, CA, USA, April 2000.

Terra, M.H.; Siqueira, A.A.G.; Bergerman, M. "Underactuated manipulator robot control via linear matrix inequalities." IEEE *Conference on Decision and Control*, Phoenix, AZ, USA, December 1999, pp. 3416-3421.

Ramos, J.J.G.; Maeta, S.M.; Bergerman, M.; Bueno, S.S.; Mirisola, L.G.B.; Bruciapaglia, A. "Development of a VRML/Java unmanned airship simulating environment." IEEE/RSJ *International Conference on Intelligent Robots and Systems*, Kyongju, South Korea, October 1999, pp. 1354-1359.

Ramos, J.J.G.; Maeta, S.M.; Mirisola, L.G.B.; Bergerman, M.; Bueno, S.S.; Pavani, G.S.; Bruciapaglia, A. "A software environment for an unmanned autonomous airship." IEEE *International Conference on Advanced Intelligent Mechatronics*, Atlanta, GA, USA, September 1999, pp. 1008-1013.

Manrich, C.; Bergerman, M. "A mobile robot navigation method using sensors for obstacle avoidance." XXII *National Conference on Applied and Computational Mathematics*, Santos, SP, Brazil, September 1999, pp. 229.

Franklin, B.; Bergerman, M. "Cultural algorithms: concepts and application to robotics." 4th *Brazilian Symposium on Intelligent Automation*, São Paulo, SP, Brazil, September 1999, pp. 625-630.

Tinós, R.; Terra, M.H.; Bergerman, M.; Soares, M.R. "Post-failure control action reconfiguration for robotic manipulators." 4th *Brazilian Symposium on Intelligent Automation*, São Paulo, SP, Brazil, September 1999, pp. 107-112.

Elfes, A.; Bergerman, M.; Carvalho, J.R.H.; Paiva, E.C.; Ramos, J.J.G.; Bueno, S.S. "Air-ground robotic ensembles for cooperative applications: concepts and preliminary results." *International Conference on Field and Service Robotics*, Pittsburgh, PA, USA, August 1999, pp. 75-80.

Siqueira, A.A.G.; Bergerman, M.; Terra, M.H. "Underactuated manipulator control system development environment." *International Conference on CAD/CAM, Robotics, and Factories of the Future*, Águas de Lindóia, SP, Brazil, August 1999, pp. RW2-13 to RW2-18.

Soares, M.R.; Terra, M.H.; Bergerman, M.; Tinós, R. "A simulation environment for fault detection and isolation and control of underactuated manipulators." *International Conference on CAD/CAM, Robotics, and Factories of the Future*, Águas de Lindóia, SP, Brazil, August 1999, pp. RW5-13 to RW5-17.

Carvalho, J.R.H.; Elfes, A.; Bergerman, M.; Bueno, S.S.; Paiva, E.C. "A methodology for aerial imagery- based ground robot navigation." *International Conference on CAD/CAM, Robotics, and Factories of the Future*, Águas de Lindóia, SP, Brazil, August 1999, pp. RT1-7 to RT1-12.

Silva, J.V.L.; Yamanaka, M.C.; Bergerman, M.; Saura, C.E. "Rapid prototyping: concepts, applications, and potential utilization in Brazil." *International Conference on CAD/CAM, Robotics, and Factories of the Future*, Águas de Lindóia, SP, Brazil, August 1999, pp. CT2-20 to CT2-25.

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Bergerman, M.; Xu, Y. "Robust control of underactuated manipulators: analysis and implementation." IEEE *Systems, Man and Cybernetics Conference*, Texas, USA, October 1994, pp. 925- 930.

Bergerman, M.; Cruz, J. J. "Robust position control of mechanical manipulators." 3rd *International Workshop on Advanced Motion Control*, Berkeley, CA, USA, March 1994.

Bergerman, M.; Cruz, J.J. "Robust position control of mechanical manipulators." 1st *Brazilian Symposium on Intelligent Automation*, Rio Claro, SP, Brazil, September 1993, pp. 135-144.

Arbex, R.T.; Bergerman, M. "Fuzzy position control of servomechanisms." *International Conference on the Industrial Applications of Electricity*, São Paulo, SP, Brazil, June 1992.

Bergerman, M.; Lobo, L.S.; Cruz, J.J. "Fuzzy control: concepts and applications." *International Symposium on Industrial Automation*, Lima, Peru, October 1991.

Bergerman, M.; Costa, O.L.V. "Stability of discrete time stochastic systems." XIII *National Conference on Applied and Computational Mathematics*, Águas de Lindóia, SP, Brazil, November 1990, pp. 147.

Other Publications

Bergerman, M. "How to build better leaders: An engineer's recipe." *Pittsburgh Post-Gazette*, Pittsburgh, PA, USA, November 2008.

Bergerman, M. "My Recipe for Leadership." *Proceedings of the* IEEE, vol. 96, no. 4, April 2008, pp. 539-540.

Video Productions

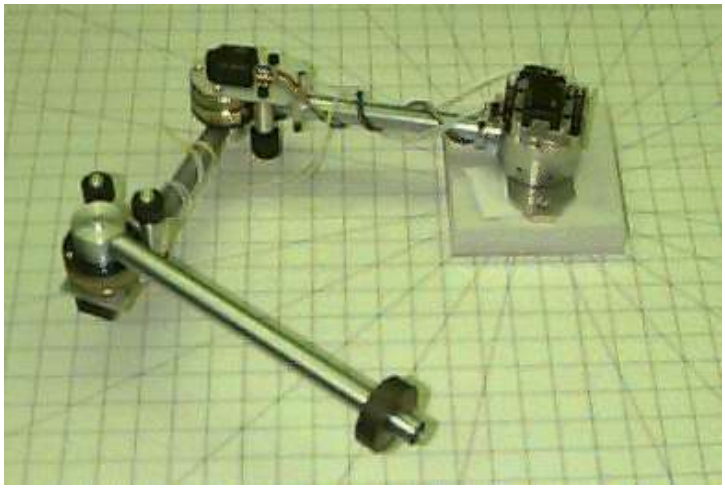
Elfes, A.; Bueno, S.S.; Bergerman, M.; Ramos, J.J.G.; Maeta, S.M.; Mirisola, L.G.B.; Paiva, E.C.; Faria, B.G. "Tropical forest aerial inspection with an autonomous airship." In "The 21st Century: The Status Quo in 9 Important Regions of the Earth." Video ed. FAW, EXPO 2000 Hannover - Millenium World's Fair Theme Park. Theme: "The 21st Century." Hannover, Germany, June - October 2000.

5. Systems Built

The following are the robotic systems I designed, programmed, and built, or whose projects I managed. In all of them I was assisted (or am being assisted) by tens of researchers, students, and engineers. A complete list of names of people who worked with me on these systems is available upon request.

U-ARM: Underactuated Robot Manipulator

U-ARM is a 3-link manipulator whose joints can be dynamically configured as active or passive. Active joints are fully-actuated by a DC motor and passive joints are equipped only with an on/off brake. All joints are equipped with quadrature encoders to measure position and velocity. U-ARM was designed and built with assistance from H. Benjamin Brown, who provided all the parts. It was used at the Advanced Manipulation Laboratory at CMU to investigate nonholonomic control of robotic manipulators.

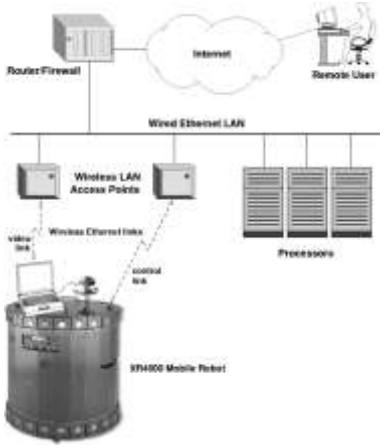


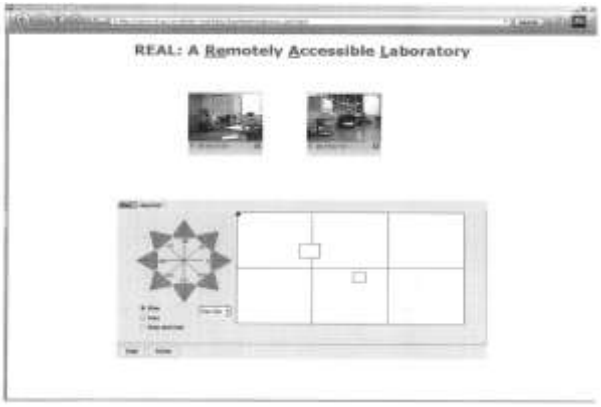
AURORA: Autonomous Unmanned Remote Monitoring Robotic Airship.

AURORA is a 30 ft. long, 10 ft. diameter non-rigid airship (commonly known as a "blimp") conceived and built for environmental monitoring missions. The base vehicle is the AS800 by Airspeed Airships. Its onboard navigation and control system consists of a PC104 computer, a GPS receiver, an inertial measurement unit, a compass, and a custom wind speed sensor. To the best of my knowledge, AURORA was the first robotic airship flown under automatic control along a pre-defined route. AURORA was envisioned by Dr. Alberto Elfes, now at JPL. In cooperation with Dr. Samuel Bueno and Dr. Josué Ramos, I secured the funding and oversaw the development of the project between 1997 and 2000.

REAL: A Remotely-Accessible Laboratory

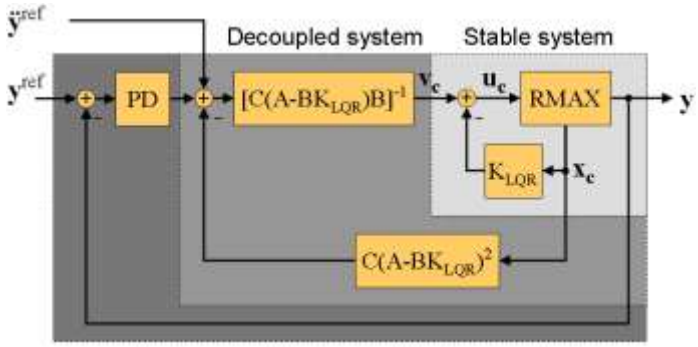
Brazil is a large country (larger than the 48 continental US states) that in 1997 had only a handful of commercial mobile robots available for research. One of them was CTI's XR4000, used by our team and students from the nearby Campinas State University. We created REAL to make the robot available on the Internet to researchers located anywhere in the country. The system allowed remotely-located researchers to upload C code to the robot located in our lab, execute experiments, and download sensor data for analysis and documentation. REAL was built partially under my supervision by Dr. Eliane Gomes Guimarães, Mr. Luciano Rodrigues de Queiroz, and other students.

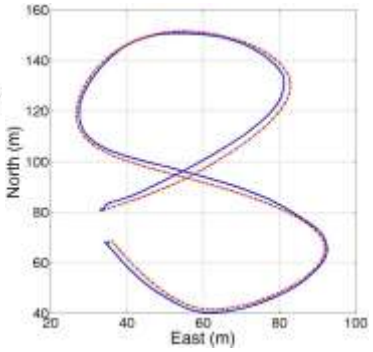




Unmanned Helicopter Navigation and Control

At the Autonomous Helicopter Laboratory at CMU I developed a novel, model-based, cascaded position and heading control method for the RMAX unmanned helicopter. The method is composed of three control loops. The inner-loop uses a linear quadratic regulator to stabilize the right-hand plane poles; the intermediate loop uses a feedback linearization controller to decouple the input/output pairs; finally, the outer loop uses a proportional-derivative controller to enable trajectory tracking. Part of this work involved recreating the helicopter's inertial navigation system for greater accuracy.





Automation for Specialty Crops

Under the leadership of Prof. Sanjiv Singh I manage "Comprehensive Automation for Specialty Crops," a $12 million project devoted to the development of a portfolio of technologies for specialty crops. These technologies include autonomous mobility, accurate localization, information management and decision-making, augmented harvesting, plant stress and disease detection, insect infestation detection, automated calipers, and autonomous crop load scouting. This USDA-funded project also includes socio-economic analyses and outreach components to foster technology transition. Among the project's 12 technical areas, I am responsible for Integration and Validation, bringing together different technologies produced by various groups across the country into complete systems.

6. Research Grants

- Co-investigator, SafeTX: Situational Awareness, Collision Avoidance & Intuitive Control for Roadable Air Vehicles. DARPA, 2010. Grant: $988,000.

Co-Principal Investigator, Comprehensive Automation for Specialty Crops. US Dept. of Agriculture, 2008. Grant: $12 million ($6 million in federal funds and $6 million in non-federal matching funds).

Co-Investigator, Fault detection and isolation for post-failure control of cooperative robotic manipulators. FAPESP, Brazil, 2000. Grant: US$58,000.

Principal Investigator, Semi-Autonomous Robotic Vehicles. FAPESP, Brazil, 1998. Grant: US$570,000.

Co-Investigator, Fault detection and isolation for post-failure control of robotic manipulators, FAPESP, Brazil, 1998. Grant: R$31.000.

7. Teaching Experience

Undergraduate-level courses: Servomechanisms and Robotics, Control Systems and Automation, Industrial Process Control, Control Systems Laboratory, and Automation Laboratory at the University of São Paulo and the Paulista University, Brazil.

> These courses were attended by some 30-50 students each. For all of them I was responsible for the syllabus, lectures and recitations, homework and exams preparation and grading, and assigning final grades. In all of them I prepared extensive courseware, including lecture notes and a DC motor and a robot manipulator simulator in Matlab.

Teaching Assistant for the graduate-level courses Computer Control Systems Design Laboratory, with Dr. Bruce Krogh, and Robot Control, with Dr. Yangsheng Xu, both at Carnegie Mellon University, Pittsburgh, PA.

> These courses were attended by ~20 students each. For both I was responsible for homework and exams grading. For the first one I was responsible for lab setup and for helping the students with their experiments and final demonstration.

Short-term course Fault-Tolerant Control of Robotic Manipulators at 13th Brazilian Automation Congress, Florianópolis, Brazil, September 2000.

> This 3-hour short course was created in cooperation with Dr. Marco Terra and attended by ~60 undergraduate and graduate students from several Brazilian universities. It included the free distribution of the Matlab robot manipulator simulator I developed during my PhD dissertation.

8. Student Advisory Experience

Ph.D. Students (co-advisor)

Eliane Gomes Guimarães, An Internet-based services framework for remotely-accessible laboratories. State University of Campinas, Brazil, 2004.

Renato Tinós, Fault tolerance for cooperative robotic manipulators. University of São Paulo, Brazil, 2003.

M.Sc. Students (advisor)

Agemilson Pimentel Silva, DSP-based implementation of an OFDM communication system. Federal University of Amazonas, Brazil, 2004.

Anastacio Mota Cavalcante, MC-CDMA: A multicarrier communication system for channel sharing. Federal University of Amazonas, Brazil, 2004.

Rodrigo Ribeiro de Oliveira, Automatic test pattern generation for the ÁGATA system. Federal University of Amazonas, Brazil, 2004.

Luiz Gustavo Bizarro Mirisola, Development of Project AURORA's ground station. State University of Campinas, Brazil, 2001.

Christian Manrich, A control architecture for cooperative robots. State University of Campinas, Brazil, 2001.

Benjamin Franklin, Artificial culture: evolutionary computing, social metaphors, and their application to robotics. Technology Research Institute, Brazil, 2000.

Luciano Rodrigues de Queiroz, A robotics and computer vision virtual laboratory. State University of Campinas, Brazil, 1998.

M.Sc. Students (co-advisor)

Diogo Zandonai, A hardware-based architecture for motion estimation applied to digital video compression. Federal University of Rio Grande do Sul, Brazil, 2003.

Luiz Poffo, An environment for digital signal processing education and learning. Federal Center for Technological Education, Brazil, 2002.

Benedito Carlos de Oliveira Maciel, Sub-optimal control of underactuated manipulators via actuation redundancy. University of São Paulo, Brazil, 2001.

Adriano Almeida Gonçalves Siqueira, H-infinity control of an underactuated robotic manipulator. University of São Paulo, Brazil, 2001.

Undergraduate Students

Supervised 12 senior project theses at the Departments of Electrical Engineering, Computer Science, and Mechanical Engineering, Universities of São Paulo and Campinas, in the areas of robot design, control, and navigation, fault tolerance, hardware and software architectures, multimedia, sensors, and interfaces.

9. Fellowships Awarded

Young Investigator Fellowship, FAPESP, Brazil, August 1998 - January 2001.

Post-Doctoral Fellowship, FAPESP, Brazil, May 1997 - July 1998.

Post-Doctoral Fellowship, CNPq, Brazil, February - April 1997.

Doctoral Scholarship, CNPq, Brazil, August 1992 - December 1996.

Master Program Scholarship, FAPESP, Brazil, March 1991 - July 1991.

Undergraduate Research Scholarship, FAPESP, Brazil, August 1989 - December 1990.

10. Participation in Scientific and Technical Committees

Member of the Carnegie Mellon University Faculty Senate since September 2009.

President of the Organizing Committee for the 4th FIRA Robocup, Campinas, SP, Brazil, August 1999.

Member of the Organizing Committee for the Workshop on the Global Integrated Circuit Design Market, Manaus, Brazil, November 2001; and the 15th International Conference on CAD/CAM, Robotics, and Factories of the Future, Águas de Lindóia, Brazil, August 1999.

Member of the Program Committee for the 2004 and 2002 Brazilian Automation Conferences; the IEEE International Conference on Mechatronics and Machine Vision in Practice, Hong Kong, August 2001; the 2000 and 2001 Congress on Evolutionary Computation; the 4th World Multiconference on Systemics, Cybernetics and Informatics, Orlando, FL, USA , July 2000.

Member of the Editorial Board, Robotics Journal, Portugal, 2000 – 2001.

11. Reviewing Activities

Reviewer for the journals: IEEE Transactions on Robotics, Journal of Mechanism and Machine Theory, Journal of the Electronics and Telecommunications Research Institute, Journal of Field Robotics, Robotica, IEEE Transactions on Robotics and Automation, Autonomous Robots, Control and Automation, International Journal of Robotics Research, Journal of Robotic Systems, Journal of the Brazilian Computer Society, Journal of Intelligent and Robotic Systems, Automatica, ASME Journal of Dynamic Systems, Measurement, and Control, IEEE Transactions on Control Systems Technology, Journal of Intelligent Service Robotics.

Reviewer for the conferences: IEEE International Conference on Intelligent Robots and Systems, IEEE International Conference on Robotics and Automation, IEEE/IAS International Conference on Industry Applications, Conference on Human-Robot Interaction, International Congress on Evolutionary Computation, Mediterranean Conference on Control and Automation, Brazilian Mechanical Engineering Congress, Brazilian Automation Congress, World Multiconference on Systemics, Cybernetics and Informatics, Latin American Congress on Automatic Control, SIBGRAPI, Brazilian Symposium on Intelligent Automation, IEEE Conference on Decision and Control.

Patent reviewer for CMU's Center for Technology Transfer.

12. Professional Memberships

Senior Member of the Institute of the Electrical and Electronic Engineers

Member of the Brazilian Automatic Control Society

Member of the International Federation of Automatic Control (IFAC)

Member of the Brazilian Scientific Society (SBPC)

13. Languages

Portuguese: Fluent

English: Fluent

Spanish: Good reading and conversational skills

Contact: marcel@cmu.edu

Marcel Bergerman is a faculty member at Carnegie Mellon's Robotics Institute, in Pittsburgh, PA, USA, where he manages development of autonomous aerial vehicles and agricultural automation systems. He received his Ph.D. degree from CMU in December, 1996. From 2001 to 2005 Mr. Bergerman worked at Genius Institute of Technology in Manaus, Brazil, as the leader of institutional relationships and knowledge management, and later as innovation manager. From 1997 to 2000 he was the coordinator of the Robotics and Computer Vision Laboratory at the Information Technology Institute in Campinas, Brazil, where he worked on Internet-accessible laboratories, autonomous robotic airships, and robotic manipulators. Mr. Bergerman has published extensively in the areas of robotics and innovation management.