IARP 2002 Brazil Status Report

Liu Hsu
liu@coep.ufrj.br
COPPE/UFRJ – Department of Electrical Engineering/PEE
Rio de Janeiro, Brazil
October 2002

Brazil Status Report Highlights: Robotics research in Brazil is steadily growing and spreading throughout the major country universities and research centers. An important account of the activities in Industrial Automation and, in particular, in Robotics is presented in a recently edited book[1] (in Portuguese) which was prepared by participants of the research network MANET (Manufacturing Automation NETwork). The network is one of the four sub-networks which form to the Industrial Automation Network, and deals with topics related with manufacturing industry and robotics. This kind of networks (with the acronym RECOPE) were supported by one major research funding agency, FINEP which is linked to the Brazilian Ministry of Science and Technology. Some of the main recent robotic projects in non-industrial environments are related to underwater robotics (usually supported by the Petroleum National Agency funds and Petrobras- the National Oil Company), piping inspection and cleaning, underwater robots for inspection of hydro-electric power plants, robots for large turbine inspection and repair (also in power plants), mobile robots (legged and wheeled), devices for TV camera motion (sport events and Carnival Shows), aerial "zeppelin" robots for inspection (environment and city security), robots to install signaling balls in electrical transmission lines (to avoid collisions with aerial vehicles), domotics, web-robots. Virtual reality and Haptics are also starting to be developed in some centers. One application is in medical robotics (telesurgery). Another major application is in the design and repair of underwater sites for the offshore industry.

For convenience, a table is included in the report to give an updated overview of the research activities being developed in Brazil in the area of Robotics. The data were collected from reports requested to several research groups that were already in our past mailing lists as well as from new groups which have presented papers in the robotics field in the national conferences. We have not noticed a substantial change in the activities of older groups but have noticed an increase in the number papers related with robotics in the national conferences such as the Brazilian Conference on Automation (*Congresso Brasileiro de Automática, September 2002, Natal*). Again, as in the 2001 report, groups included in the past reports that did not answer to our request are marked in red colour. Those that did not reply but are known to be active are in blue colour. Their information were not updated.

[1] "Industrial Robotics: Applications in Manufacture and Process Industries", edited by V. Romano, Edgard Blücher Ltd., 2002.

University/Research Center	Group Leader	Research Areas
COPPE/Federal University of Rio de Janeiro Department of Electrical Engineering Group for Simulation and Control in Automation and Robotics **(GSCAR)**	Liu Hsu liu@coep.ufrj.br	• Mobile robots and mobile manipulators: motion planning, navigation and intervention tasks. • Contact and force control • Coordinated motion control of vehicle-manipulator and multi-robot systems • Computer vision navigation, handling and visual servoing • Navigation by sensor fusion (GPS, inertial platforms, etc.) • Use of industrial robots for underwater operation and intervention (with CENPES) • Development of new Pressure Tolerant Electronics for hyperbaric mechatronics • Automated pipeline inspection using robotic device (with CENPES-PETROBRAS) • UAVs: Helicopter control
COPPE/Federal University of Rio de Janeiro Department of Mechanical Engineering	Max S. Dutra maxdutra@ufrj.br Vitor F. Romano romano@serv.com.ufrj.br	• Robot mechanical design • Mechatronics design • Mobile robots; legged robots • Entertainment robotics • Underwater technology • Biomechanics for medical applications • Walking mechanisms • Non-invasive surgery • TV camera motion devices

University/Research Center	Group Leader	Research Areas
ITA - SP **Aeronautics Institute of Technology** Dept. of Mechanical Engineering	Luiz Carlos Sandoval Góes goes@mec.ita.cta.br	• Flexible robots • Intelligent control systems • Parameter identification • Aerospace applications • Advanced robot control • Force/torque control • Mechatronics and integrated products design • Flexible automation • Medical surgery applicatrions
ITA - SP **Aeronautics Institute of Technology** Department of Systems and Control	Elder M. Hemerly hemerly@ele.ita.cta.br	• Navigation and control of autonomous mobile robots (K-team Khepera robotics, ISR Magellan Pro) • Vision feedback • Autonomous learning and low level control: neural and wavelet networks • Adaptive control applied to robotic vehicles • Software for robotic systems
UNICAMP - SP Campinas State University Department of Mechatronics	João Maurício Rosário rosario@fem.unicamp.br	• Biocybernetics in motion rehabilitation • Flexible manufacturing cells • Coordinated control of manipulators • Actuators for limb prostheses • Rapid prototyping

University/Research Center	Group Leader	Research Areas
CENPES/PETROBRAS Rio de Janeiro	Ney Robinson S. dos Santos salvireis@cenpes.petrobras.com.br	• Adapting industrial robots for deep water robotics (with COPPE) • Development of new pressure tolerant electronics for hyperbaric mechatronics (with COPPE) • Robotic devices to prevent and eliminate deep water pipeline clogging (GIRINO) • Automated pipeline inspection using robotic device (with COPPE/GSCAR)
UFES Federal University of Espírito Santo Department of Electrical Engineering	Mário Sarcinelli Filho mario.sarcinelli@ele.ufes.br	• Robotic Systems • Robot modeling • Robot control • Mobile robots • Autonomous mobile robots • Underwater robotics • Sensing for robotics • Computer vision • Visual-based robot navigation
FCTI - SP Technological Foundation Center for Informatics Robotics and Computer Vision Laboratory	Samuel Siqueira Bueno Samuel.Bueno@iti.gov.br	• Robotic vehicles for inspection and environmental monitoring • Software and hardware achitectures for robotic systems • Telepresence / autonomy in robotic vehicles • Computer vision systems for robotics and inspection

University/Research Center	Group Leader	Research Areas
UFRN Federal University of Rio Grande do Norte Intelligent Systems Lab	Adelardo A. D. de Medeiros adelardo@dca.ufrn.br	• Underwater ROV for rotor inspection in hydro-electric turbines • Aerial autonomous vehicle for visual leak detection in petroleum pipelines • Autonomous robotic guide for museums • Fleet of autonomous mobile micro-robots • Low-cost manipulator robots • Visual servoing for mobile and manipulator robots using fast image processing algorithms • Trajectory planning for non-holonomic mobile robots • Task planning for cooperative multi-robots • Adaptive and intelligent control of mobile and manipulator obots • Image processing for pattern detection in indoor, outdoor and underwater environments • Formal methods for validating task plans
UFRGS Federal University of Rio Grande do Sul Laboratory of Intelligent Robotics	Dante Augusto Couto Barone barone@inf.ufrgs.br	• Voice synthesis and voice recognition • Computer vision: face-recognition system • Men-machine interfacing • Robot arm for video-laparoscopic surgery • Evolutionary robotics

University/Research Center	Group Leader	Research Areas
UFSC Federal University of Santa Catarina Mechanical Engineering Department	Raul Guenther guenther@emc.ufsc.br	• Advanced Robot Motion Control • Force Control in Robot Manipulators • Dedicated robot for turbine blade inspection and repair • Advanced control for hydraulic actuators
UFMG Federal University of Minas Gerais Department of Computer Sciences	Mário Fernando Montenegro Campos mario@dcc.ufmg.br	• Autonomous mobile robots • Aerial robots • Cooperative robotics • Visual and haptic collaborative tele-presence • Rehabilitation robotics • Robotic vision • Robot development
UFRGS **Federal University of Rio Grande do Sul** Mathematics Institute	Valdir L. Roque roque@mat.ufrgs.br	• Autonomous mobile robotics • Path planning with global vision system
UFSC **Federal University of Santa Catarina** Conexionism and Cognitive Sciences Lab.	Mauro Roisemberg mauro@inf.ufsc.br	• Hierarchical and modular neural networks for behavior based robotics

University/Research Center	Group Leader	Research Areas
USP **University of São Paulo** Department of Telecommunication and Control	José Jaime da Cruz jaime@lac.usp.br	• Visual path control using CCD camera
UNB - DF University of Braília **GRACO** (Group for Automation and Control) (Not updated)	Sadek Crisostomo Absi Alfaro sadek@graco.unb.br	• Model Acquisition/Structural Identification • Computer Vision for Robotics • Distributed Intelligent Systems for the Automation of Manufacturing • Robotic Underwater Welding
USP University of São Paulo Department of Mechanical Engineering, Mechatronics (Not updated)	Júlio C. Adamowski jcadamow@usp.br	• Industrial Robotics for manipulation and inspection • Control of mechatronic systems • Object modeling with image processing • High rigidity pneumatic motors for a pneumatic robot • Stereo vision for measurement • Vision applications in Intelligent Buildings • Advanced robot control • Sensors
USP University of São Paulo Department of Electrical Engineering (Not updated)	Anna H. Reali Costa anna.reali@poli.usp.br	• Vision systems • Robot control • Mobile robots • Motion planning

University/Research Center	Group Leader	Research Areas
UNICAMP - SP Campinas State University Department of Mechanical Engineering (Not updated)	Douglas Eduardo Zampieri douglas@fem.unicamp.br	• Control of nonholonomic mobile robots • Neuro-Adaptive control of flexible robots
UFMG Federal University of Minas Gerais Department of Mechanical Engineering (Not updated)	Alexandre Q. Bracarense queiroz@vesper.demec.umfg.br	• Robot welding
UNIJUI - RS Regional University of Northwestern Rio Grande do Sul Integrated Manufacturing Program (Not updated)	Antonio Carlos Valdiero valdieiro@sede.inijui.tche.br	• Robotics and Industrial Automation • Automated tests of products and processes
University of Rio Grande Foundation Department of Mathematics Núcleo de Matemática Aplicada **(NUMA)** (Not updated)	Sebastião C. P. Gomes dmtscpg@furg.br	• Modeling and Control • Flexible Manipulators • Simulators with manipulator interface

University/Research Center	Group Leader	Research Areas
NCE/UFRJ **Federal University of do Rio de Janeiro** Robótica e Automação Inteligente (Not updated)	Eliana Prado Lopes Aude elaude@nce.ufrj.br	• Voice Recognition • Computer Vision • Motion planning • Sensor Fusion • Intelligent control
Federal University of Uberlândia -MG Department of Electrical Engineering (Not updated)	Edilberto Pereira Teixeira edilbert@ufu.br	• Neuro-fuzzy control • Tuning of Fuzzy Controllers using Genetic Algorithms
IME – RJ Military Institute of Engineering Mechanics Engineering Department	Armando Morado Ferreira armando@epq.ime.eb.br	• Unmanned vehicles systems for civilian and military use • Trajectory planning and control of unmanned vehicles
IME – RJ Military Institute of Engineering Systems Engineering Department	Paulo Fernando Ferreira Rosa rpaulo@leblon.ime.eb.br	• Dynamic System for Housing Automation • Robot Cooperation for Navigation on Unstructured Environments • Virtual Manipulator: The Transmission of the Haptics Perception • INDIMADA: An Algorithm to Control Transmission System of a Vericle through Data Inference • Scrollic Grippers: dexterous manipulation with rolling and compliance