

Robotics and Automation Activities in Brazil

By Edson Prestes, Vitor Jorge, Mario Campos, and Roseli A.F. Romero

We are starting a series focusing on robotics and automation activities in the BRICS countries: Brazil, Russia, India, China, and South Africa. The objective of this series, in addition to providing an assessment of the state of the art, is to inform the readers of the unique challenges and solutions that these countries have adapted to their problems

and to facilitate a discussion with the IEEE Robotics and Automation Society and other members of the community. This article, the first in the series, focuses on Brazil. Please send your comments and feedback to the Vice President of the Industrial Activities Board Raj Madhavan at raj.madhavan@ieee.org.

Covering an area of 8.5 million km² and with a population of around 200 million people, Brazil emerged in the international scene as a country with a solid economy and stable currency, being able to cope with the disastrous effects of the current global economic crisis. It recently received the investment grade from prominent risk-assessment agencies, which means the country is more likely to meet payment obligations, attracting more investments. In addition, Brazil, Russia, India, China, and South Africa formed a group known as *Brazil, Russia, India, China, and South Africa (BRICS)* to discuss and implement ways to improve the global economic scenario. Brazil is also a full member of the Mercosur and actively participated in numerous United Nations missions.

Regarding robotics and automation, Brazil has a small number of factory-installed robots, 20/10,000 employees, when compared with developed countries. According to the International Federation of Robotics, robot sales in Brazil reached 1,440 units in 2011, 125% more than in 2010 [1]. This number is gradually increasing in different industry segments such as automotive, consumer electronics, and beverages. Large companies such as EMBRAER, FIAT, Ford, GM, Phillips, Tramontina, Nestlé, and

Chocolates Garoto S.A. installed robotics work cells in the past few years. In these cases, robots are used in applications such as tightening screws, welding, painting, molding, forging, and soldering in the automotive industry and pick and place tasks in the consumer electronics industry. Small- and medium-sized companies are also beginning to adopt robots to increase the production volume and improve the quality of their products while reducing operational costs. There are mostly international players in industrial robot manufacturing, e.g., Asea Brown Boveri, Siemens, FANUC, and KUKA. Regarding other segments, Brazil has few enterprises that build and deploy robots, for instance, X-Bot, Instor, AEL Sistemas, Modelix Robotics, and ARMTEC.

The robotics and automation research in Brazil is mainly conducted at public universities and a couple of government labs. However, there exist some public-private initiatives, e.g., EMBRAER and Aeronautics Technological Institute (ITA). They develop robots that are used, in the aviation industry, as part of the structural assembly line and in the process of joining metal parts of the aircraft. Petrobras Research Center developed a four-wheel remote-controlled robot capable of traveling and monitoring different regions, including land, water, and swamps [2]. It also conducts research on autonomous underwater vehicles

(AUVs) to monitor deep-sea waters [3]. The number of robotics and automation papers in the main national conferences sponsored by professional and academic societies such as the Brazilian Automation Society, Brazilian Computing Society, and the Brazilian Society of Mechanical Sciences has significantly increased in the last decade. Currently, several Brazilian authors publish papers in the best international journals and conferences.

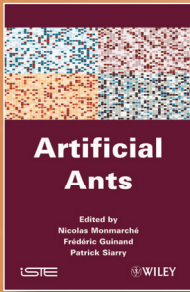
The potential of robotics application in Brazil is vast and not yet explored. Brazil has large gas and oil fields both inland and in the presalt region of the Atlantic Ocean. There are several challenges in oil production, ranging from underwater inspection, monitoring, assembly, and repair to remote operation of production platforms. Petrobras leads the use of robotics in pipe inspection, environment control, and mining initiatives. Smaller companies also have a share in this market, often in cooperation with larger companies, providing specialized robots for duct/pipe and oil tank inspection to maintain the integrity and safety of facilities' infrastructure.

The Brazilian defense ministry is investing on several projects related to robotics. One of them involves the use of unmanned aerial vehicles for border control, vigilance, target tracking, and recognition. Brazilian Federal Police (PF) have acquired the Hermes 450 developed by AEL Sistemas S/A, which

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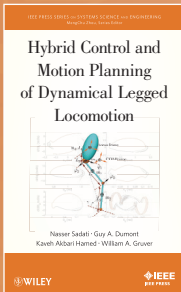
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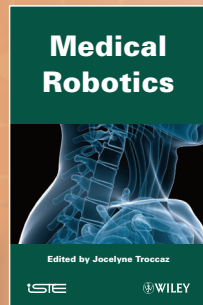
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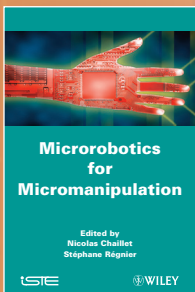
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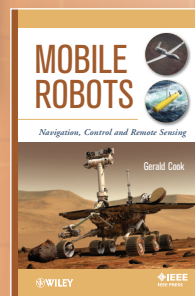
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also recently developed for the Brazilian army a robotic nontriplated turret for the new Brazilian Guarani tank. There are other robots built for defense and security purposes that can be employed in complex tasks, including disarming bombs and fire fighting. CAIPORA [4], developed by ARMTEC, is a firefighting robot, whereas Xiru Evolution [5] is being developed by Instor and Nitro in partnership with PF to disarm bombs. Because of issues related to national security and governmental directives, the Ministry of Defense gives precedence to companies that respect the premises of technology transfer and the sovereignty of Brazilian airspace [6].

Several companies are developing educational robots, e.g., Xbot develops and sells small robots for education and entertainment. Robots such as the Curumin [7] are used to teach programming and robotics concepts and are also used in research in universities and technical schools. The Brazilian academic community also stimulates

young students through national competitions, such as the Brazilian Robotics Competition and the Brazilian Robotics Olympics. The latter event has several modalities, including written tests and practice tests involving the construction of robots and a duathlon, where both written and practice examinations are applied.

In the past few years, Brazil demonstrated outstanding performance in economic and social areas. However, there are several challenges yet to be addressed, such as poverty, public health and safety, logistics infrastructure, and sustainable development, many of which can be successfully addressed with robotics solutions.

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