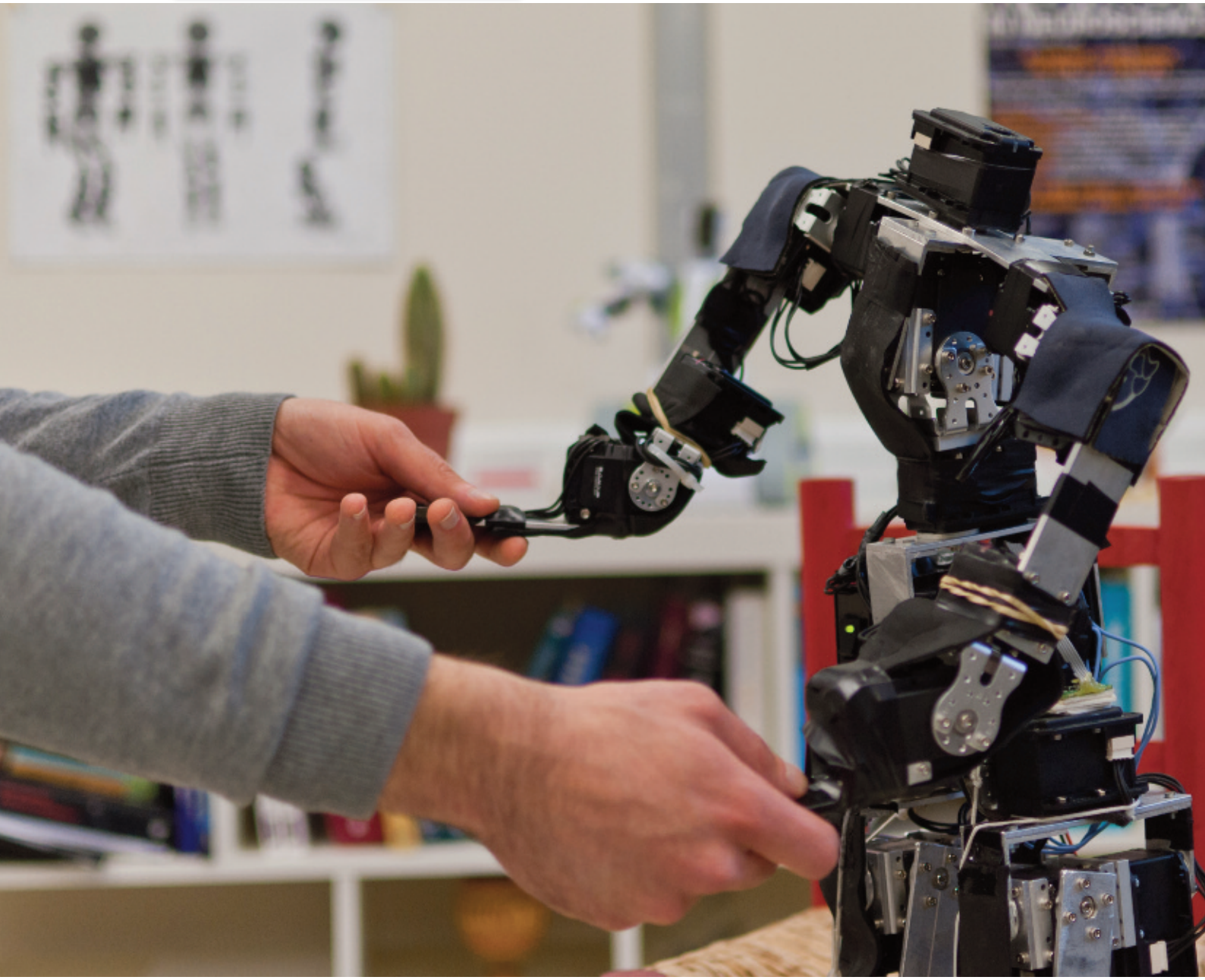
Press Release

INRIA announces the birth of Acroban, the first humanoid robot that can be taken by the hand

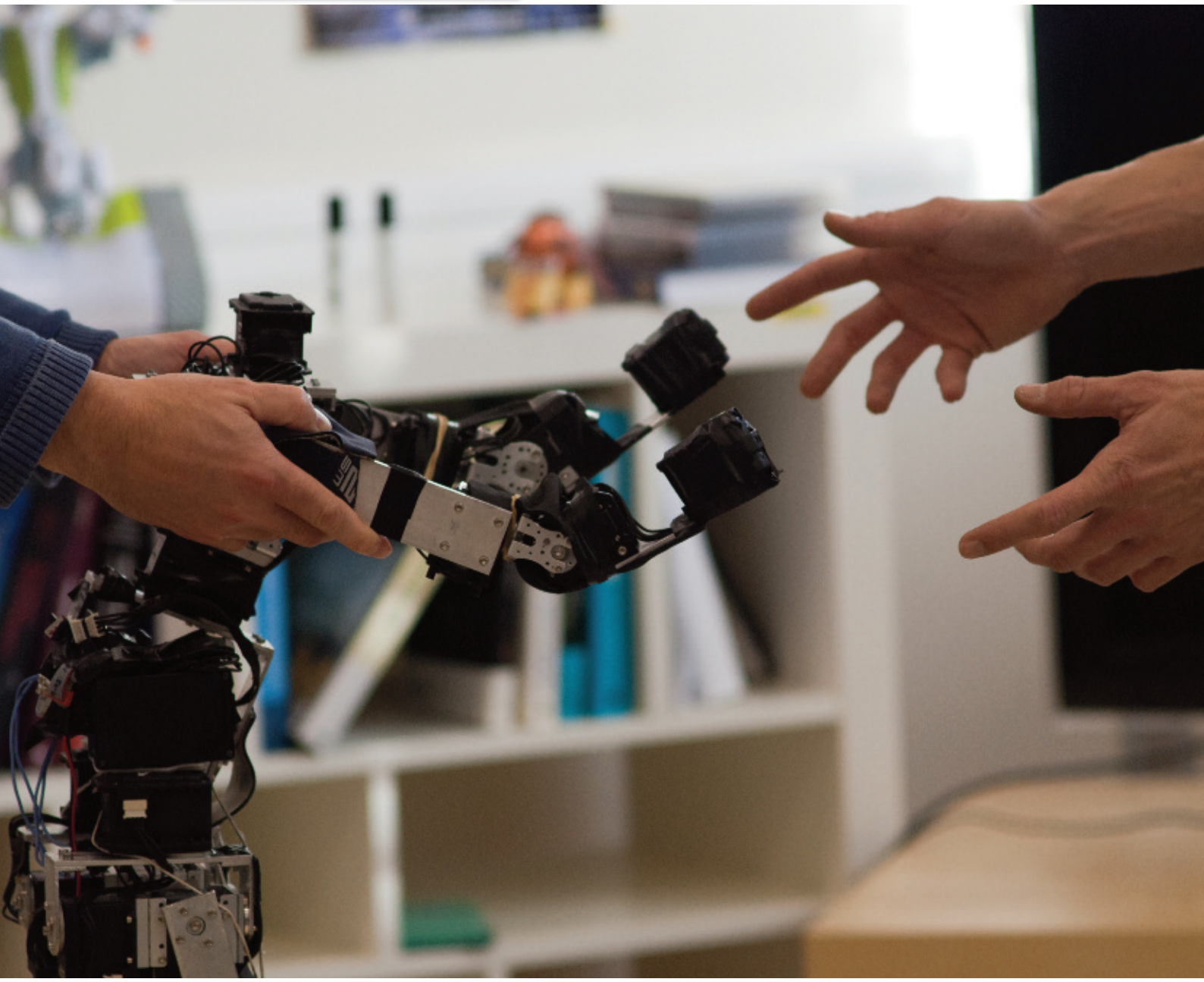
UNIVERSITÉ BORDEAUX 1 Sciences Technologies

LaBRI

INRIA



The research team FLOWERS at INRIA Bordeaux - Sud-Ouest, in collaboration with the LaBRI (Bordeaux I University), has designed the first humanoid robot that allows fluid physical interaction that is intuitive and robust, even with children. In order to be realized on a larger scale, and respond to society issues such as maintenance of a home for the elderly, a personal robot must be affordable and sufficiently reliable in order to be in contact with people, adults and children alike. Initially instigated for fundamental research on movement and learning, Acroban responds to these two objectives and opens new perspectives for personal robotics in the future.



Personal Robotics and Assistance for Individuals

The robotics market never ceases to progress and the ABI Research cabinet estimates that it will reach 14 billion euros in the horizon of 2015. In the 21st century, personal robots will be part of our daily lives in the way that computers or automobiles are in the 20th century. To have a robot at home to do the housework, direct work plans, and assist the elderly by supporting the nurse or simply to have fun with us is no longer an inaccessible dream of futuristic fiction.

But who could imagine a robot integrated into our daily landscape if it is impossible to touch, to guide while taking it by the hand without putting people in danger or without risk of destroying it?

Who could imagine a robot that falls each time a child pushes it a little too much? Or would break with the slightest fall? Which costs more than a house?

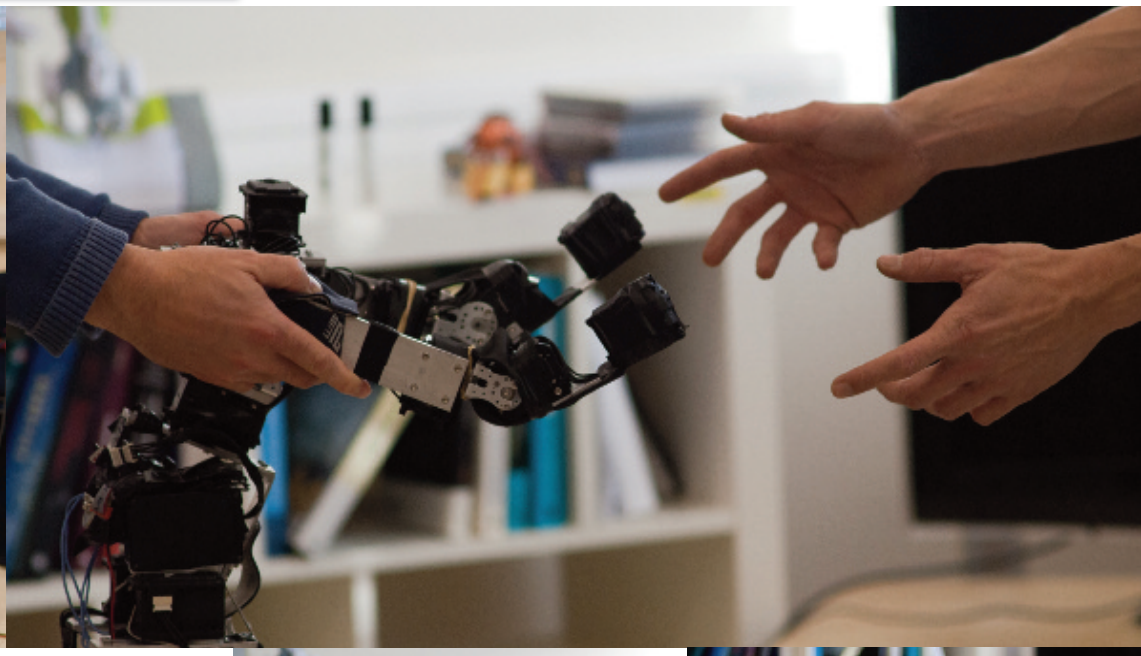
Introducing Acroban, a new French humanoid robot developed by a research team at INRIA Bordeaux – Sud-Ouest, LaBRI and the University of Bordeaux 1. It is the first biped humanoid that permits fluid physical interaction that is intuitive and robust, even with children.

A New Type of Human-Robot Interaction: Taking Acroban by the Hand

Despite a visual appearance lacking cosmetics and being neither “round” nor “cute”, Acroban very quickly evokes a bond or even emotion. In effect, his movements are uniquely natural, provoking an illusion of life owing to strong inspiration drawn from the physical movements of humans. The entire body becomes an interface which can be manipulated directly. Acroban can be taken by the hand and be directed without a joystick or verbal command, even by a child.

Acroban is equally extremely robust. If a human pushes him as he walks, he doesn’t fall. He can strike an obstacle placed in front of him without losing his equilibrium. If he was to fall, the material which he is composed of is sufficiently solid in order not to be broken. If one of the motors of his legs is damaged, Acroban can still continue to walk and hold his balance.

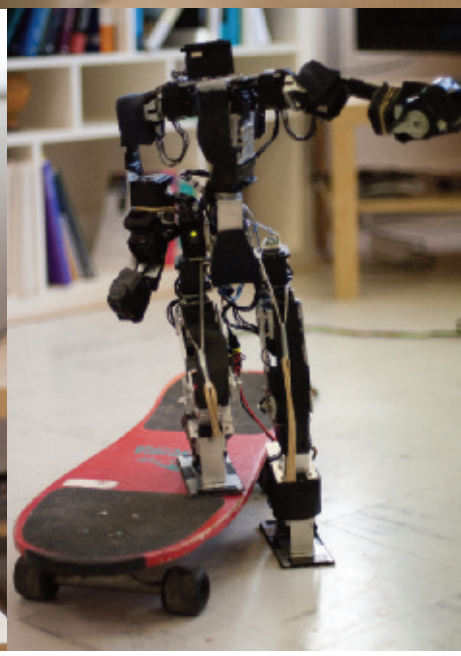
Acroban is composed of motors, construction and electronic materials, which are inexpensive for a robot of this complexity. In effect, his naturally stable global architecture and robustness does not require custom precision of motor components, as these are off-the-shelf parts. This makes the robot low cost.



Capabilities related to the combination of four innovations:

A vertebral column and bio-inspired materials: in contrast to most humanoid robots, which are equipped with a rigid box in place of a torso, Acroban has a multi-articulated vertebral column inspired by human morphology, which plays an essential role in locomotion and maintaining equilibrium in humans, and offers new possibilities for humanoid robots.

Softness: the motors and the structure of Acroban are 'soft' i.e. they can be deformed gently when forces are applied to them and therefore able to absorb shock. The motors can be programmed to simulate virtual springs. In addition real springs and elastic are used in assembling the body of Acroban, mimicking the role of tendons or muscles.



Passive dynamics inspired from Humans: when a human walks and moves, he uses gravity as well as the inertia of his body in order to conserve energy. The human walk consists essentially of a fall perpetually caught. The principle is applied to Acroban, as for other recent robots, but extended in this case to the whole body and the torso in particular.

Lightness and the possibility to acquire new movements by trial and error: carrying out a movement with a robot is an extremely difficult task, in particular when it's a matter of movements such as dynamic walking whose physical complexity is very large. Most of the humanoid robots developed up to the present were too expensive, too fragile and too dangerous to permit the testing of these movements directly on the robot. A lot of modeling and simulation was necessary before transferring the movement to the robot.

A radically different methodology was used on Acroban. Being lighter, more robust and less expensive, the FLOWERS research team at INRIA was able to experiment with movements directly on it. It is how he has acquired the capacity to walk dynamically.

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Developmental Robotics developped within the Flowers research team at INRIA Bordeaux - Sud-Ouest

Acroban was developed in order to explore fundamental scientific questions concerning motor behavior (for example in walking) and social behavior (interaction with others), which could be acquired by human, and robots. In particular, Acroban permits better understanding of the role of morphology, materials and physique, as well as constraints that aid in sensorimotor development if their properties are suitable. Acroban also allows the exploration of new modes of interaction between humans and robots. Its conception is based on theories from bio-mechanics, neurosciences and psychology. This approach permits not only the development of new technologies, but equally constitutes an opportunity to confront scientific models of human development with reality. The results of this research provide, for example, new hypotheses on human movement, in particular on the role of the vertebral column in human locomotion.

Acroban has been elaborated in the framework of a project financed by the European Commission through the European Research Council (ERC) program. This project, called EXPLORERS, began in 2009 for the duration of five years and a budget of 1.5 million Euros.

Videos and website:
http://flowers.inria.fr/acroban.php

About INRIA

Public establishment for scientific and technology research, under the purview of the Ministries for Research and for Industry. Annual budget (2011) : 231.1 M€ of which 26% is own resources. Eight regional centers of research: Paris - Rocquencourt, Sophia Antipolis – Méditerranée, Grenoble – Rhône-Alpes, Nancy – Grand Est, Rennes – Bretagne Atlantique, Bordeaux – Sud Ouest, Lille – Nord Europe, Saclay – Île-de-France. 3,150 researchers working in more than 170 project teams of which most are affiliated with other organizations, grandes ecoles or universities. 4,100 collaborators across France. 80 teams associated worldwide. One hundred companies created since 1984.

In order to know more : **inria.fr**

About LaBRI

LaBRI is a research unit associated with CNRS (UMR 5800) at the University of Bordeaux 1 at IPB and the University of Bordeaux 2. Since 2002, it has been a partner of INRIA. Its staff has increased significantly in recent years. In January 2010, it brought together 340 people of which 104 were research professors (Bordeaux 1, 2 et 4, IPB), 35 researchers (CNRS, INRIA), 22 technical and administrative staff (Bordeaux 1, IPB, CNRS, INRIA) and more than 135 doctorates, post-doctorates and contract engineers. The missions for LaBRI revolve around three principle axes: research (theoretic, applied), development – transfer of technology and training. The support of the Conseil Régional d'Aquitaine through the extension of the building, equipment and the bursaries and post-doctorates was an essential part of the development of LaBRI.

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