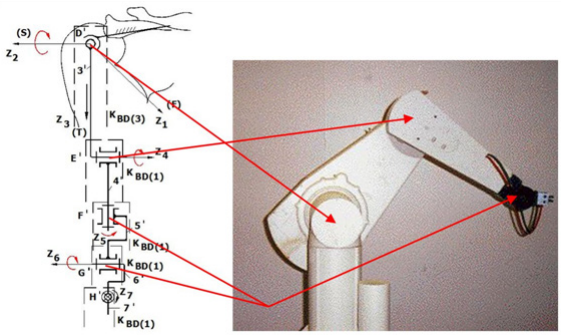
NEW HAPTIC ARM EXOSKELETONS FOR ROBOTICS AND AUTOMATION IN SPACE

Goal of the project

The project seeks to develop in Romania the capacity to design and manufacture special assemblies meant to work in the field of Robotic Exploration. The overall goal is to stimulate Romania's participation to international space missions and programs, in collaboration with ESA (European Space Agency), as its 19th member. The practical task is to develop a new haptic arm exoskeleton designed to enable in-space force-feedback telemanipulation with redundant robotic arms.

Short description of the project

EXORAS will provide a new haptic arm exoskeleton for robotic exploration. The exoskeleton is desired to explore future ways of commanding a manipulator arm in space. It will be created a prototype with special features of the design, namely several shortcomings of previous telemanipulation systems will be removed. The new system pursues requirements regarding weight, ease of wearing and comfort of the human operator. The project assumes the full design, assembling and testing of the prototype. All aspects are taken into account: kinematics, dynamics, sensorics, wireless control, haptic feed-back, actuation, materials and so on.



Project implemented by

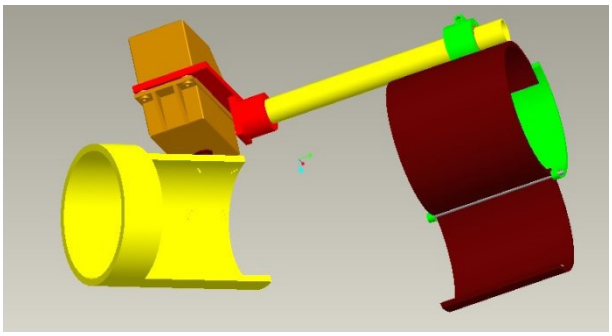
- Technical University of Cluj-Napoca – Coordinator
- University "Transilvania" Brasov – Partner 1
- University Politehnica of Timisoara – Partner 2

Implementation period

2012 - 2015

Main activities

- Research on the development of exoskeleton haptic systems for robotic exploration (existing solutions and development of new solutions; establishment of basic components with functional and technical specifications)
- Concept, design and assembly (mechanical design, kinematic analysis, development of control software, simulation)
- Testing and optimizing of prototypes (assembling, testing and optimizing of prototypes)



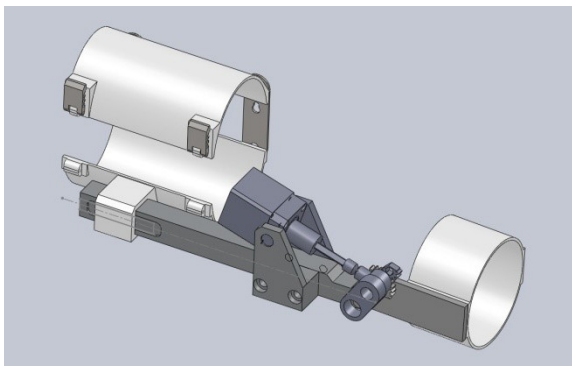
Results

At this stage, the research work on existing solution lead to the design and partial implementation of new six solutions of exoskeleton arm. A generic scheme of the general concept from kinematic point of view is given in figure 1.
The solutions developed until now focused mainly to the elbow joint, which, functionally, is considered the most representative. The six variants of exoskeleton under study use:

- servo rotary drive mounted directly on the shaft of the joint (fig. 2)
- linear actuation and transformation of motion (fig. 3)
- free motion and electromagnetic brake (movement transmission via a wire mechanism)
- free motion and electromagnetic brake (fig. 4)
- haptic feedback generated by myostimulation
- haptic feedback generated by vibration modules.

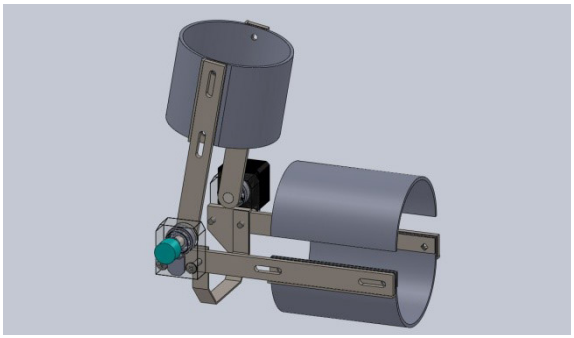
Applicability and transferability of the results

EXORAS fulfills entirely the scope of STAR program (of Romanian Space Agency) that aims increasing of the research competitiveness for participation of academic entities to activities of ESA, included in the law no. 262/2011 regarding the membership status to ESA. This project is going to produce clear benefits to the consortium partners and beyond, regarding the competitiveness of the market for hi-tech mechatronics and robotics. In addition, the gain in knowledge is going to be transferred into the higher-education support.



Fields of interest

- robotics
- haptic devices
- mechanisms science
- automated control
- space exploration



Research centre

Research Centre for Mechatronics and Robotics

Financed through/by

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Research team

E.-C. Lovasz, V. Ciupe, D. Mărgineanu, C. M. Gruescu, I. Cărăbaş, E. Zăbavă, A. Diaconu, I. Maniu, V. Dolga, M. Mateaş.

Contact information

Assoc. Prof. Erwin-Christian LOVASZ, PhD
Department of Mechatronics
Address: Bv. Mihai Viteazu, No.1, RO300222, Timisoara
Phone: (+40) 256 403 542
E-mail: erwin.lovasz@upt.ro