CONTEST

“Bionics for Tomorrow – How can we improve human-robot interaction?”

Objective

While technological improvements in artificial intelligence and robotics are continuously reshaping our daily lives, humans are still clearly outperforming robots in most of the motor activities of daily living, especially for what concerns object physical interaction. This happens even if robotic hardware (actuators) definitely outperforms humans' hardware (muscles). Why are humans better than robots? How can we improve robots to fill this existing gap? In this contest you will be tasked to think, model, design and validate a preliminary solution to help reducing the current gap between human and robot performance.

Specific Objective

Every team is tasked to develop a proof-of-concept physical prototype that can potentially emerge as a future advancement in bionics, with a particular emphasis on human-machine interaction. Among the different expressions of bionics, particular interest is given to the fields of rehabilitative and assistive technologies such as prostheses and exoskeletons. Assistive and rehabilitative devices capabilities to match human biomechanical and physiological requirements are a fundamental aspect to guarantee a comparable quality of life to impaired individuals.

No particular constraints are placed on the type and level of the developed solution. Nonetheless, at the end of the contest, every team should be able to answer the following questions:

- Background & Motivation
  - How did you come up with your idea? Which problem is it solving? What's the motivation?
- Modelling, Design and Manufacturing
  - Model: How did you go from the idea to the engineering solution?
  - Design: How did you translate from your model to the physical device?
  - Manufacturing: How did you assemble your system?
- Validation and Impact
  - How did you validate your system performance?
  - What is the potential impact?
- Discussion, Limitation and Future Works
  - What are the key advantages and disadvantages of your system?

- How can you improve your current design?
- What are the next steps?

These questions will be used also as a metric for evaluating the performance of each team.

- Quantitative answers (analytical calculations, numerical estimates, simulations and experiments) will be given priority to qualitative answers (opinions, questionnaires, perceptions, intuitions).

Target and Participation Modality

- Every team should be composed by minimum 3 and maximum 4 students
- Any student starting from the 2nd year of bachelor's degree is eligible
- Every team should have at least one student from a Master's degree course acting as "Team Captain"
- The contest is centered around Engineering (mechanical, biomedical, electrical, electronic, computer, mechatronic, etc.) but students coming also from the courses of Medicine, Biotechnologies, Mathematical and Physical Sciences are welcome (maximum a non Engineering student per team).
- Every team should write to chiara.michelis@camplus.it a short (1 page max) motivational letter to present the team members and explain their interest in participating to the contest. The letter should be written in English and signed by all team members. Details on each team member academic course and academic year are required. It's necessary to indicate a Team Captain and a name for the team
- The deadline is on 29th February
- No more than 3 teams per Camplus will be selected

Partner

- Federico Tessari, Senior Postdoc Associate at MIT, Boston (USA)
- A jury to be defined

Project Phases

- **Within 19/02** – Publication of the contest
- **Within 29/02** – Students' enrollment
- **Within 04/03** – Teams established and beginning of the contest
- Each team will have about 2 months to complete their project and will have a little budget (to be defined) to be used for the prototype, if deemed necessary
- A final presentation (in English) will be hosted remotely within the end of May (the date will be communicated maximum 1 month before)
  - Every team will have time to pitch their work, present their prototype, and answer a Q&A session

    - A jury composed by the tutor and at least three additional judges will evaluate the team and select the winner
    - The final judgement will be based on the final presentation (60%) and by the interaction of the main tutor with the teams (40%).
- An initial seminar on **04 March 19.30-21.30** will be given by the main tutor to provide the necessary theoretical and scientific background to support teams' preparation for the contest. The participation is mandatory for at last 1 member of the team.
- Every team will have - across the contest period – at least 2 one-to-one meetings with the tutor to review their work, evaluate their project and get feedback. Such meetings will be planned directly by the team and the main tutor (flexibility by the team members is required).

Prize

The prize consists of a team trip to Boston lasting approximately one week, including a day at MIT under the guidance of researcher Federico Tessari. Air travel costs (Italy/Boston) and overnight stay will be covered. Participants will be responsible for food and any local travel.

The trip will be scheduled in autumn 2024 based on the availability of the main tutor.