PhD position - MoPDOM

Model Predictive Control for Deformable Object Manipulation

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Context

MoPDOM will develop reliable control strategies for robotic manipulation of deformable objects. Although many well-established methods exist for handling rigid objects, the manipulation of flexible and soft systems often relies on human intervention. This is primarily due to the complexity associated with the perception and modeling of deformation. The present project will bring together different state-of-the-art methods for modeling, perception, and control of robotic systems to manipulate deformable objects with reliability. The robotic manipulation will be performed by means of Model Predictive Control (MPC). Illustrative examples of the studied scenarios are depicted in Figure 1.

MPC is an advanced control architecture that computes in real-time the upcoming optimal trajectory satisfying control and state constraints. This is particularly useful since maximal efficiency is often obtained with conditions close to the system constraints. Moreover, thanks to its predictive nature, MPC can anticipate future changes during online computation of the optimal trajectory.

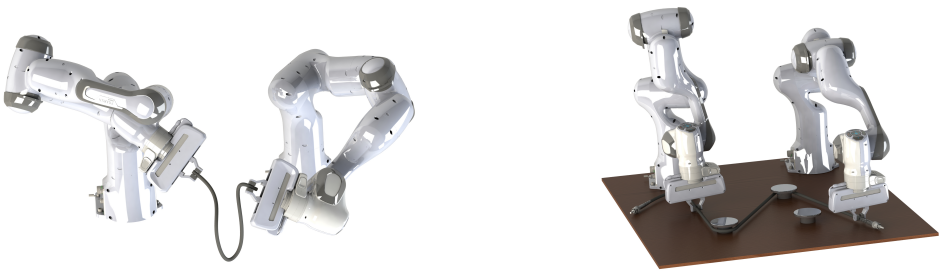

Figure 1: Studied scenarios of dual-arm manipulation of deformable objects.

Position description and responsibilities

Throughout a three-year period, the PhD candidate will engage in the following activities:

- Development of MPC schemes for the manipulation of deformable objects;
- Experimental validation with a dual-arm robotic system;
- Modeling through finite element methods (FEM);
- Implementation of perception techniques using depth camera feedback;
- Writing reports and scientific papers in peer-reviewed journals.

Eligibility

- Master's degree on robotics or related topics;
- Solid background on Python and C++ programming;
- Basic knowledge related to numerical optimization;
- B2 spoken and written English;
- Desirable experience with finite element methods;
- Desirable experience with MPC.

Working environment

The PhD candidate will be supervised by João Cavalcanti Santos and Andrea Cherubini, LIRMM, Montpellier, France. Enjoying over 300 days of sunshine annually, Montpellier offers a delightful Mediterranean climate that fosters a relaxed and enjoyable lifestyle. With its diverse population and international student community, Montpellier offers a cosmopolitan lifestyle enriched by cultural diversity. An internationally renowned laboratory, LIRMM research activities led to relevant results in fields including high-speed industrial robotics, human-robot interaction and construction robotics.

Application

Prospective applicants are invited to submit a single PDF file containing both their cover letter and CV to joao.cavalcanti-santos@lirmm.fr and andrea.cherubini@lirmm.fr. The start work date is flexible, but preferably September/October. The deadline for applications is **April 22, 2024**. Please ensure that the subject line of the email follows the format

"*MoPDOM PhD application - [Applicant's Name Surname]*".