The Multibody & Mechatronic Systems lab develops research projects in the field of modelling methods and system dynamics with applications in robotics, deployable structures, and biomechanics. This includes numerical methods for the following advanced problems:

- **Flexible multibody dynamics** (FE formulations for beams, shells, and superelements).
- **Mechatronic simulation** (control/structure interactions).
- **Model reduction** (real-time control & monitoring, optimization processes).
- **Contact interactions** (impact and friction phenomena, nonsmooth dynamics).
- **Mechanism synthesis** (pre-design tool).

Applications in spacecraft design:
- Solar panels
- Antennas
- Solar sails
- Reflectors
- Telescopes

Deployable structures have to satisfy tight requirements in terms of weight, folded compactness, geometrical accuracy in the unfolded configuration. Reliable models are needed to support the design phase.

We study compliant components which offer significant advantages for low-cost missions. Our research activities are related with their nonlinear modelling and experimental validation as well as their design and optimization.

Robotics and mechatronic systems

The behaviour of mechatronic systems relies on close interactions between mechanical and control components. Design procedures should thus rely on a concurrent control/structure engineering approach.

- **Trajectory planning** (collision avoidance).
- **Motion and vibration control**.
- **Mechatronic optimization** (control/structure design).
- **Industrial robotics & cobots**.

Human motion analysis and biomechanics

The Laboratory of Human Motion Analysis (LAMH) studies the motion of elite athletes (e.g., tennis, running) and patients suffering from movement disorders (e.g., Parkinson disease).

In that context, our research activities cover the following topics:

- **Model-based signal processing** (artefact compensation, data fusion, Kalman filtering, feature extraction).
- **Biomechanical & neural control modelling** (inverse dynamics, gait simulation).
- **Design of equipments** (prosthesis, low-cost & ambulatory sensors).