Mechanical measurements for space missions

Space missions rely on several optical and mechanical accurate and precise measurements that contribute to the navigation of the spacecrafts, as startracker or navigation accelerometers, to the correct alignment and positioning of its parts, as gauges for the attitude control of antennas, or to the scientific success itself, as for interferometry in space. Future mission will try to extend the functionalities of a single satellite to that offered by a satellite constellation that will behave as a single entity. These extended systems will rely on accurate sub-millimeter relative positioning of the units of the constellation, as in the case of array telescopes formed by a fleet of identical elements. In this case laser ranging and non-contact optical measurements will play an incomparable role.
The PhD student will develop new high resolution state of the art interferometry, optical measurement of angles and distances and different kind of proximity measurement especially designed for space applications.

In particular, the length department of the INRIM has active many projects with ESA and ASI on the development of accelerometers for space application and geodesy. This activity ranges from the interferometric reading of inertial references for new generation accelerometers to the development of test boards for electrostatic geodetic reference systems, as the Gravitational Reference System of the LISA Space Mission of ESA that will place a Gravitational Waves antenna, formed by three satellites, on a Solar orbit trailing the Earth.

The PhD student will:

a) contribute to the development and design of original interferometric setup with low noise and accuracy at the mHz frequency band to read the position of a reference test mass;

b) participate to the tests that will be performed at the Einstein elevator at the Hannover Institute of Technology ;

c) participate to the design of the future cube sat missions to test the interferometric reading of accelerometers in space;

d) contribute to the development of a ground test board emulating the behavior of the electrostatic Gravitational Reference System of the LISA test mass.

During the period of the Ph.D. the student will acquire the following competencies:

a) Design and realization of complex optical systems

b) High resolution laser interferometry;

c) Finite element simulation;

d) Programming in LabVIEW for the acquisition and analysis of data

e) Design and realization of vacuum systems