



PHASE 1 B:

LEARNING ABOUT SPACE SYSTEMS: FUNDAMENTALS OF SPACE ENGINEERING

COURSE B - ... : SPACE ROBOTICS

TEACHER: Prof. Giancarlo GENTA

The aim of the course is to deal with automatic machines aimed to operate both autonomously and as a support to astronauts in space exploration missions. The attention will be concentrated on robotic devices designed for planetary environment, including small planets, comets and asteroids.

Program:

- Introduction: overview of human and robotic space exploration; man-machine cooperation in exploration.
- The environment: Moon-Mars environment. Very low gravity environments, asteroids and comets. Type of ground, distance from Earth, communication delay.
- Tasks: Autonomous machines and teleoperators. Exploration missions, Sample-return missions, Bioastronomy missions, Missions for preparing human landing, Planetary exploitation, Cooperation with astronauts, Robotic manned vehicles.
- Mobility: wheels, tracks, legs, hybrid systems, unconventional devices.
- Wheeled vehicles: Wheel properties, rolling resistance, longitudinal forces, lateral forces, steering, suspensions, wheeled vehicle dynamics and control.
- Legged vehicles: leg-ground contact, gait, configurations, legged vehicles dynamics and control.
- Power systems for robots: power requirements, batteries, solar cells, nuclear power units, chemical power units, fuel cells and internal combustion engines, on site fuel production.
- Vision systems, on board arms and manipulators, communications, payload interfaces.
- Future possibilities: biomimetic systems, microrobots, swarms of cooperating robots.