An Introduction to Spatial (6D) Vectors and Their Use in Robot Dynamics

Unit code: (filled by Unige administrative office)

Scientific Disciplinary Sector: ING-INF/04

Number of hours: 10

Credits: 4

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AIMS AND CONTENT

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Learning Outcomes (short)

The course provides an introduction to spatial vector algebra, which is a tool that simplifies the task of solving problems in rigid-body dynamics by reducing the quantity of algebra needed to describe and solve a problem, and reducing the amount of computer code needed to calculate the answer.

Learning Outcomes (further info)

Spatial vectors combine the linear and angular aspects of rigid-body motion, so that a single spatial vector can provide a complete description of a rigid-body's velocity, acceleration, momentum, or the forces acting upon it. The result is a large reduction in the quantity of algebra needed to describe and solve a problem in rigid-body dynamics: fewer quantities, fewer equations, and fewer steps to the solution. There is also a large reduction in the quantity of computer code needed to calculate the answer. This course explains spatial vectors in sufficient detail to allow students to understand what they are, how they work, and how to use them in their own research.

Syllabus/Content

- vectors and vector fields

- motion and force

- Plucker coordinates

- differentiation and acceleration

- equation of motion

- motion constraints

Prerequisites: A basic knowledge of Newtonian dynamics is required (i.e., dynamics using 3D vectors), such as can be obtained from a first course in dynamics at undergraduate level. A basic knowledge of linear algebra is also required (vector spaces and subspaces, bases, coordinates, linear independence, range and null spaces of a matrix, etc.)

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WHO

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Teacher: Roy Featherstone, roy.featherstone@iit.it

HOW

Teaching Methods

The course will be taught by means of lectures and class exercises. Lecture notes will be provided, as well as supplementary materials for self-study.

Exam Description

There will be an oral exam based on the lecture material.

Assessment Methods

The course will be assessed by oral exam only. Students wishing to take the exam must make an appointment with the teacher.

WHERE AND WHEN

Lesson Location

IIT Morego (room not allocated yet).

Lesson Schedule

Four 2.5-hour sessions in the afternoon on Monday 16th, Tuesday 17th, Wednesday 18th and Thursday 19th May.

Office hours for students

The teacher is available at most times and on most days to answer students' questions face-to-face or by email. No appointment is required.

CONTACTS

The teacher's office is on the top floor of the new IIT building on via San Quirico (CRIS). Students can contact him via email: roy.featherstone@iit.it