1SC2192 – Modeling of a polyarticulated vascular radiology robot

Instructors: Emmanuel Godoy
Department: DOMINANTE - GRANDS SYSTÈMES EN INTERACTION
Language of instruction: FRANCAIS
Campus: CAMPUS DE PARIS - SACLAY
Workload (HEE): 40
On-site hours (HPE): 27,00

Description

During vascular operations (heart, lungs, brain), interventional radiology is an essential aid for surgeons. A vascular radiology system can consist of one or two polyarticulated robots, placed on the ground or suspended. The system studied here has five motorized axes allowing the movement of the imaging system consisting of an X-ray tube and a receiver. The level of accuracy required during movement is closely related to the imaging objective and depends in part on the design of the actuating system. In addition, to guarantee safety, this type of system must be able to remain stationary in the event of a power failure, which leads to a specific choice and dimensioning of the motorization chain. In addition, since the robot shares its workspace with the medical staff, the problem of detecting unexpected collisions arises in order to ensure staff safety. This challenge week deals with the modelling of this type of robot taking into account its multi-axis structure.

Quarter number

ST2

Prerequisites (in terms of CS courses)

None

Syllabus

Possible projects:

- Development of a simulator for a dynamic model of the Innova robot
- Identification of the parameters of a dynamic model of an interventional surgery robot
- Modeling of an irreversible transmission chain
- 3D robot trajectory planning for a "cardiac spin" analysis
- Development of a model of a two-wheel drive carrier robot

Grading

involvement in the team work during the challenge week + deliverables at the end of the week + final defense

Resources

1. Room for 30 students, with projector, organized in blocks by group
2. 3 teachers per room
3. Matlab/Simulink (network access for license) on individual students' PCs

Learning outcomes covered on the course

At the end of this challenge week, students will be able to:

- Describe the current context of medical robotics through the main technical, application and economic challenges associated with it.
- Identify current topics in medical robotics, and describe their technical specificities.
- Describe the main hardware and software components of an industrial and medical robotic system.
- Develop and simulate models of polyarticulated or mobile robots.
- Designing, modeling and simulating a motorization chain.
- Analyze a system in interaction with the external environment.

Description of the skills acquired at the end of the course

- C1 - Analyze, design, and build complex systems with scientific, technological, human, and economic components
- C4 - Have a sense of value creation for one's company and one' customers
- C7 - Know how to convince
- C8 - Lead a project, a team