MA 505- Advanced Robotics

Course Code:	MA-505
UTAA Credit (Theoretical-Laboratory hours/week):	3(3-0)
ECTS Credit:	6.0
Department:	Mechanical and Aeronautical Engineering
Language of Instruction:	English
Level of Study:	Graduate
Offered Semester:	Fall and Spring Semesters.

Course Objectives

To teach vector techniques in mathematical modelling of robotic mechanisms. To teach how to obtain the mathematical model of complex robotic mechanisms in compact form using Spatial Operator Algebra. To teach the concept of singularity and zero dynamics in the mathematical model of a robotic system. To teach complexity order of DOF (degrees of freedom) dynamical modeling technique.

Course Content

Spatial velocity concept and rigid body velocity propagation, rotation matrix and Rodriguez formula, kinematical modeling of a serial manipulator using Spatial Operator Algebra, visualization of kinematical modeling of a serial manipulator by Matlab Simulink 3d animation toolbox, inverse kinematics, singularity and redundancy, kinematical constraints of cooperating manipulators, kinematical modeling of cooperating manipulators on a mobile platform, inverse kinematical modeling of cooperating manipulators on a mobile platform, visualization of kinematical modeling of cooperating manipulators on a mobile platform by Matlab Simulink 3d animation toolbox, dynamical modeling of a serial manipulator using Spatial Operator Algebra, mass matrix factorization technique, dynamical constraints of cooperating manipulators, dynamical modeling of cooperating manipulators on a mobile platform, Matlab Simulink 3d animation for dynamical modeling of cooperating manipulators on a mobile platform

Course Learning Outcomes

1-vectoral techniques in mathematical modelling of robotic mechanisms

2-how to obtain the mathematical model of complex robotic mechanisms in compact form using Spatial Operator Algebra

3-the concept of singularity and zero dynamics in the mathematical model of a robotic system

4-complexity order of DOF (degrees of freedom) dynamical modeling technique