

Underactuated mechanical systems

doc. dr. sc. Tihomir Žilić,

Faculty of Mechanical Engineering and Naval Architecture, Zagreb,

e-mail: tzilic@fsb.hr

Abstract

Underactuated nonlinear mechanical systems (UNMS) are systems whose dimension of input control space is less than dimension of its configuration space. A difficulty of the control problem for UNMS is due to the reduced dimension of the input space. Euler-Lagrange's approach to UNMS mathematical modeling is used, with classification to holonomic and nonholonomic systems together with definitions of UNMS with input coupling. A challenging problem in control of UNMS is simultaneous stabilization and trajectory tracking of arbitrarily selected degrees of freedom.

This lecture will present:

- one way of transformation of differential equations of UNMS from Euler-Lagrange equations to nonlinear state space form, affine in control variable,
- nonlinear control law for simultaneous stabilization and trajectory tracking based on sliding surfaces control methodology,
- open problems in determining Lyapunov stability of the control law.