Algebraic Input-output Angle Equation Derivation Algorithm for the Six Distinct Angle Pairings in Arbitrary Planar 4R Linkages

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Abstract

This seminar will focus on kinematics, more specifically, on function generation of four-bar linkages. I will present part of my research where we will have a look at a generalised algorithm that can be applied to any single degree of freedom parallel kinematic chain to determine the algebraic polynomial that represents the input-output equation relating any pair of distinct angles between any pair of links in the kinematic chain. There are six such algebraic polynomials for an arbitrary four-bar linkage. The algorithm consists of several steps requiring knowledge from robotics, and algebraic geometry. In particular, the seminar will cover the following theories:

- Denavit-Hartenberg parametrisation
- Study's kinematic image space
- Elimination theory

Example applications are discussed for continuous approximate synthesis, mobility classification, and the design parameter space.

Biography

Before moving from Germany to Canada, Mirja completed her undergraduate studies in Industrial Engineering, worked for a few years in a manufacturing company and obtained a professional certification in Software Engineering. She completed a master degree in Mechanical Engineering at Carleton University and is now pursuing a PhD in the same field under the supervision of M. John D. Hayes. Mirja's PhD research is focused on motion transfer of four-bar linkages which can be used in a multitude of applications, such as robot wrists, suspension systems, or windshield wipers. She has been working on a method to obtain the algebraic input-output equation for any kinematic architecture of four-bar linkage, including planar, spherical and spatial linkages. Mirja's research has resulted in a multitude of publications which she has presented at reputed international and national conferences.