On the Computing of Optimal Motion for 321 Kinematic Chains with Geometric Constraints

Dmytro Chibisov
Institut für Informatik
Technische Universität München
chibisov@in.tum.de

Abstract

We present an algorithm for computing the motion of so-called 321 kinematic chains, which belong to the class of serial robots and are widely used for many industrial applications. After a suitable parametrization of the solution space, the problem can be reduced to the finite dimensional one. Since 321 chains admit closed form solutions for inverse position and inverse velocity problems, finding a minimum of a certain cost function can be performed using Newton like iterative methods. However, due to the high number of local minimas, in order to perform the global optimization the decomposition of the parameter space with respect to the sign of gradients of individual cost functions is requiered. Thus, we present an approach to the parameter space decompositoin based on elemination of variables from systems of polynomial equations. Depending on the particular parametrization of the solution space the costs of algebraic computations, on the one hand, and, the computational costs of numerical iterations, on the other hand, may vary very much. The computational examples and comparsion will be given.