Tools for non polynomial kinematics: interval analysis, continuation and neural networks

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Abstract: Kinematics is a core element for the analysis of robots and we may distinguish inverse kinematics and direct kinematics for both redundant or non redundant mechanisms. In each case one or both kinematics problems may have multiple solutions and a crucial point for the mechanism analysis is to determine all kinematics solutions (or the solution that is a global extremum for a given criteria) for a large number of inputs.
We will first describe classical, but not so well known, methods that allow to deal with non polynomial equations, namely interval analysis and continuation. More recently neural networks have been considered and we will show that they may be efficient in some cases provided that the structure and the training of the networks take into account a careful analysis of the kinematics problem.