Computer algebra tools have been used since a long time for theoretical studies of parallel manipulators like computing the maximum number of solutions for the direct kinematic problem. Recent progress in algorithms for computing Gröebner basis and for the exact study of real roots have enhanced the computational capabilities of dedicated computer algebra systems for the study of the direct kinematics problem, so that now we can start using such tools in practice for studying real and industrial situations.

The first part will be devoted to the description of new algorithms and software solutions for the study of the direct kinematics problem . We will show how we can simplify efficiently the related systems of algebraic equations and then isolate all their real roots in an exact way. The first step is equivalent to eliminate variables of the the algebraic system that modelises any direct kinematics problem $\{h_1(X_1,\ldots,X_9)=,\cdots=h_9(X_1,\ldots,X_9)=0\}$.

- the **elimination phase** produces an equivalent system (Rational Univariate Representation) in the form :

$$\begin{cases} f(T)=0 \\ X_1 = g_1(T)/g(T) \\ \vdots \\ X_9 = g_9(T)/g(T) \end{cases}$$

- the **isolation phase** takes the result of the elimination phase , isolates the real roots (with multi-precision rational bounds) of the first polynomial (f) and computes isolation intervals for all the coordinates $X_1,\ldots,X_9$, providing in addition an algorithm for refining as precisely as we want the solutions.

These algorithms are implemented in FGb/RS software and it takes few seconds to compute all the real roots for practical examples.

The second part will describe an extension of such a computation to path planning. In particular we will demonstrate how the elimination phase of the computation can be used safely for choosing the right path (among the 40 possibilities) given a parametric description of any trajectory and an initial position.

The third part will be devoted to the description of an industrial example

on which such a algorithms have been applied, providing at the end a kind of classification of the capabilities of the given parallel manipulator depending on the available hardware and real-time numerical methods.