Chapter 8

Scope of further work

There exist plenty of related research topics that have not been fully addressed in this thesis or that they have been simply remarked without carrying out a deep analysis, which constitute interesting and new directions for future work. Several perspective research directions based on the conclusions and the contributions of the present work can be outlined as under:

The proposed design of 3-PRS parallel platform has showed a promising performance and revealed some of its potentials in the synthesis process. Trajectory planning, statics and dynamics should be followed for the practical applications point of view for such type of manipulator. Performing dynamic analysis is only possible after completing mentioned synthesis and kinematic analysis of manipulator under consideration. Reaction and actuator forces can be calculated by writing necessary Newton-Euler equations. Lagrange equation of motion is another method to determine these forces-moments. It is suggested to analyze the force actuated on end-effector when the manipulator is moving from one location to another location. In this way, assessment of the smooth trajectory planning is indirectly attained.

It is recommended to experiment with the motion of manipulator and its control. Hydraulic or pneumatic systems can be used to vary the lengths of the prismatic joints and to control the pose of the end-effector on moving platform. Structure parameters optimization of the proposed architecture should be carried out keeping in mind its actual usage for an industrial application.

One may introduce known joint errors either at prismatic joints or in passive revolute joints to predict the behavior of the manipulator and its associated compensation techniques for the required trajectory planning. This leads to new research dimensions in field of parallel manipulator. This proposal is more challenging specifically for parallel manipulation compared to serial ones due to its complex kinematic configuration. Finally, vibration analysis of the manipulator is vital for its candidature as a precise industrial manipulator. Here, natural frequency of actuated links is important. Additional work should be explored in designing an extension mechanism or modification of moving platform design that holds various tools.
The study is more focused on kinematic, workspace analysis and performance measurement point of view in the present work. Bezout’s method used in this thesis is faster and provides closed form solution at least for the class of fully symmetrical parallel manipulators. Numerical methods are another alternative approach and may be applied to a wide class of different mechanisms. Different applications other than industrial applications could be figured out to take advantage of the contributions of this work. For example, parallel micro-manipulators, surgical instrument mechanisms for head injuries, human prostheses or satellite tracking could be imagined, which can be characterized by high structure rigidity and slow motion properties.