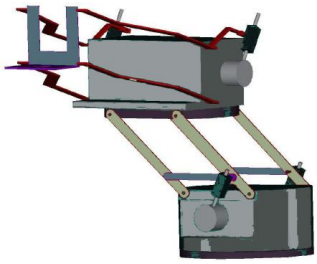
Parallel Mechanisms
Chairs: J. Angeles, Manfred Husty

A Novel Manipulator Architecture for the Production of SCARA Motions

J. Angeles, A. Morozov and O. Navarro
McGill University

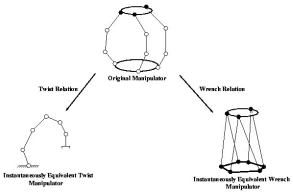
- The need to move moderately heavy loads keeping them horizontally
- Two serial arrays of tilt-pan motion generators are used
- None of these. A preliminary design is reported
- SCARA motions for moderately heavy loads can be produced with a structure stiffer than current SCARA systems



Analytic Jacobian of In-Parallel Manipulators

D. Kim, W. K. Chung and Y. Youm
Pohang University of Science & Technology (POSTECH)

- A consistent formulation of (inverse) Jacobian matrix.
- Reciprocal screw relation is used.
- Analytic expression of reciprocal screw is developed.
- Any (6-DOF) manipulator can be analyzed consistently.



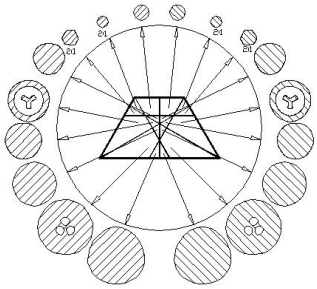
Determination of the Carriage Stroke of 6-PSS Parallel Manipulators having the Specific Orientation Capability in a Prescribed Workspace

T. Huang[1], B. Jiang[1] and D. J. Whitehouse[2]
[1]Tianjin University and [2]University of Warwick

On the Optimum Design of Planar 3-DOF Parallel Manipulators with Respect to the Workspace

Xinjun Liu, Zhenlin Jin and Feng Gao
Yanshan University

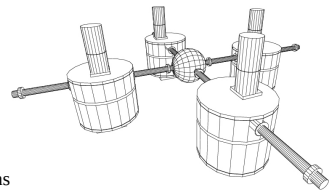
- In the field of optimal design of parallel manipulators, two problems are distinguished: performance evaluation and synthesis. The second problem is to determine the geometry of the manipulator. The classical methods of optimal design, like the cost-function approach, have difficulties to deal with this problem. Many factors, such as workspace, dexterity, singularity, stiffness, are involved in the process of optimal design of manipulators. The major obscure in this process is how to illustrate the relationships, from which we can determine the link lengths of manipulators, between the performance criteria and the link lengths of manipulators.
- The paper presents a useful design tool, the physical model of the solution space, which can be used to express the relationships between the performance criteria and the link lengths of manipulators. Then the performance atlases, which are useful for the designer to design robots, can be obtained.
- The workspace for planar 3-DOF parallel manipulators is investigated in the design tool, and the performance atlases for workspace volume and workspace shape are obtained. The results are useful for the design of the parallel manipulators
- The results show when the workspace volume and workspace shape for planar 3-DOF parallel manipulators can reach optimal result. The technique used in this paper can also used to study other performance criteria and the optimal design of other serial or parallel manipulators.



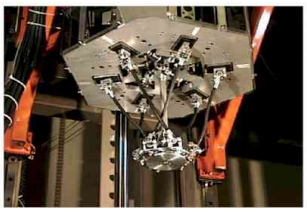
On the Stability Conditions for a Class of Parallel Manipulators

M. M. Svinin[1], K. Ueda[1] and M. Uchiyama[2]
[1]Kobe University and [2]Tohoku University

- Stiffness and stability of force distributions
- Conditions for symmetry of the stiffness matrix
- Center of stiffness and conditions for stability
- Stabilizability of unstable distributions in singular configurations



Workspace Analysis of the ParaDex Robot– a novel, Closed-Chain Kinematically-Redundant Manipulator

Y. Wang[1], W. S. Newman[1] and R. S. Stoughton[2]
[1]Case Western Reserve University and [2]MicroDexterity Systems, Inc.

- Motivation: new parallel-mechanism design has complex workspace
- Approach: develop fast collision-detection algorithms for this robot
- Results: can evaluate poses within 0.5ms on PC
- Conclusions: the C-space is complex, but manageable