CHAPTER - 7

CHAPTER-7

General conclusion

The work presented in this thesis relates to the development of a direct, reliable and unified approach for the synthesis and analysis of simple jointed planar kinematic chains.

It has been shown that the planar n-link, f-degrees of freedom kinematic chains can be synthesized in two phases.

1. By joining two binary links in form of a string to (n-2)-link, f- d.o.f chains and
2. By first generating (n-1)-link, (f+1) degrees of freedom chains and then converting them to n-link, f-d.o.f chains by joining a binary link across non adjacent links. The method envisages generation of chains progressively from chains with lower number of links.

The data generated during synthesis is used to reveal type of freedom and symmetry among simple jointed planar kinematic chains. Symmetry is used to compare the chains for their expected performance in terms of out put error. Results are verified by taking up numerical examples.

The unified methodology of synthesis and analysis is based on Hamming codes. The concept is borrowed from digital communications. The Hamming matrix gives exact information regarding the number of identical links and joints in a chain. This information is utilized in structural synthesis to generate only distinct kinematic chains. Slight modification in the original hamming matrix reveals best actuator pairs.

The following work has been carried out:

1. A catalogue of simple jointed planar kinematic chain up to 13-link,2-d.o.f is reported
2. Complete analysis (inversions, best inversion for path and function generation, type of freedom and best actuator pair) up to 12-link,1-d.o.f is reported
3. Rating of chains in terms of structural error for 9-link, 2-d.o.f is presented for space constraint however, a general methodology for rating is formulated

4 Numerical examples have been taken up to validate the results of rating obtained for simple jointed planar kinematic chains by the proposed methodology.

The investigation carried out and presented in the thesis has following salient features,

1. Formation of degenerate chains is altogether eliminated
2. Number of distinct chains from all the basic chains is quite small
3. Isomorphism tests are strengthened by using secondary and tertiary Hamming matrix as an isomorphism index
4. Higher degrees of freedom kinematic chains are obtained as a by product
5 Method is extremely simple during formulation stage since the only input necessary is connectivity matrix, which can be built up easily and consists only of 0 and1.
6. Notation used to represent a chain is suited for storage and manipulation on computers
7. Method is simple during execution stage since it involves only arithmetical computations which is easy for computer
8. Method is processing real chains hence chances of missing any chains are rare
9. As the generation is progressive the genesis of chains is clearly defined hence it is easy to sketch the chain
10. Inversions are read of as an by product of chain Hamming strings
11. Sorting the matrices only that reveal inversions gives best inversion for path and function generation
12. The result obtained by new methodology of synthesis and analysis generally agree with the result of other investigators but present approach has yielded new result like ;

- Number of distinct kinematic chains is obtained up to 13- link, 2-d.o.f by the proposed methodology is 29008 against 29704 reported by Hwang and Hwang.
- Complete analysis (inversions, best inversion for path and function generation, type of freedom, and best actuator pairs) up to 12-links,1-d.o.f is obtained by the proposed methodology

- Rating for structural error of simple jointed planar kinematic chains is obtained up to 11-links, 2-d o f.

The unified program for structural synthesis and analysis of simple jointed planar kinematic chains using the proposed methodology is likely to be of great help in exploration of new mechanisms.