[Kamble, 5(1): January-March, 2015] ISSN: 2277-5528
Impact Factor: 2.745 (SIJF)

INTERNATIONAL JOURNAL OF ENGINEERING SCIENCES & MANAGEMENT

ALGORITHM ON SYNTHESIS OF FOUR BAR MECHANISM USING THREE PRECISION POINTS

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Abstract

This paper deals with solution methods of optimal synthesis of planar mechanisms. A searching procedure is defined which applies genetic algorithms based on three precision points. Problems of synthesis of four-bar planar mechanisms are used to test the method, showing that solutions are accurate and valid for all cases. The possibility of extending the method to other mechanism type is outlined. The main advantages of the method are its simplicity of implementation and its fast convergence to optimal solution. This paper deals with algorithm on synthesis of four bar mechanism using three precision points

Key word –Synthesis of mechanism, three precision points

I. INTRODUCTION

If numbers of bodies are assemble in such way that the motion of causes constrained and predictable motion to the other it is known as mechanism. Combination of mechanism is known as machines. Machines consist of number of mechanisms in their system for their successful operation and to give desired output. Mechanisms are used for transmitting motion, force, torque, etc. Mechanisms like four bar mechanism, single slider crank mechanism, double slider crank mechanism, etc., are used.

One of the main objects of designing a mechanism is to develop a system that transforms motion in a specific way to provide mechanical advantage. A typical problem in mechanism design is coordinating the input and output motions. A mechanism is designed to produce a specified output as a function of input is called a function generator. A system that transmits forces in a predetermined manner to accomplish specific work may be considered a machine. A mechanism is the heart of a machine. It is a device that transforms one Motion, for example the rotation of a driving shaft, into another, such as the rotation of the output shaft or the oscillation of a rocker arm. A mechanism consists of a series of connected moving parts which provide the specific motions and forces to do the work for which the machine is designed. A machine is usually driven by a motor which supplies constant speed and power. It is the mechanism which transforms this applied motion into the form demanded to perform the required task. The study of mechanisms is very important. Any mechanism is synthesized and designed to get desired performance/output in terms of motion, torque, force, displacement, etc. There are various links or dimensions of the mechanism. Any change in one or all link lengths affects on the performance of the mechanism. Software is to be developed for calculating performance. Kinematic synthesis of mechanism is one of the essential steps of the machine design. According to the duty of machine, several types of mechanisms can be synthesized and largely number of different configurations can be found. After the type of mechanism is determined, the dimensional synthesis has to be performed. Prescribed position synthesis is the most common method for dimensional synthesis and this is the basis of this thesis subject. The prescribed position synthesis is commonly divided into three parts. These are namely, motion generation, path generation and function generation. Motion generation deals with rotation and translation of a body while it passes from several positions. Path generation deals only translation of a point and function generation is about correlation of input and output motion.

For all these tasks, two curves are obtained which satisfies the prescribed positions namely centre and circle point locus. These loci show the fixed and moving pivots of the suitable mechanism respectively.

In mechanism synthesis, if the design conditions are suitable, there are an infinite number of solutions and it is engineer's ability to judge and select suitable mechanism type and configuration. Even though various analytical methods have been developed for synthesis of mechanisms, it still depends on trial-error and repetitive tasks which causes loss of time and money.

II. ALGORITHM

1) Start
2) Declaring the variables A2, A3, B2, B3, C2, C3, D2, D3, theta, fi, si, sigma
3) Initializing the sixteen values of the right side matrix
4) Initializing the difference between first and second geometry : P21
5) Initializing the difference between first and third geometry : P31
6) Initializing the four equations of the right matrix with values : y1,y2,y3,y4
7) finding the cofactor matrix from the original matrix
8) Calculating the adjoint of the right matrix from the cofactor matrix
9) Calculating the determinant of the right matrix
10) If determinant = = 0 then
Print "inverse is not possible"
If not
Calculate the inverse of the right matrix
Printing the inverse of the right matrix

11) Multiplying the inverse of the matrix with the original and the side matrix to obtain the Wx, Wy, Zx, Zy
12) Finding the w and z using
$w = sqrt[(Wx)^2 + (Wy)^2]$
$z = sqrt[(Zx)^2 + (Zy)^2]$
13) finding the theta and fi using
$theta = cos^{-1}(wx/w)$
$fi = cos^{-1}(zx/z)$
14) Initializing the sixteen values of the left side matrix
15) Initializing the four equations of the left matrix with values : y1,y2,y3,y4
16) finding the cofactor matrix from the original matrix
17) Calculating the adjoint of the left matrix
18) Calculating the determinant of the left matrix
19) If determinant = = 0 then
Print "inverse is not possible"
If not
Calculate the inverse of the left matrix
Printing the inverse of the left matrix
20) Multiplying the inverse of the matrix with the original and the side matrix to obtain the sx,sy,ux,uy
21) Finding the s and u using
$s = sqrt[(sx)^2 + (sy)^2]$
$u = sqrt[(ux)^2 + (uy)^2]$
22) finding the sigma and si using
$sigma = cos^{-1}(ux/u)$
$si = cos^{-1}(sx/s)$
23) creating the geometry from the above calculated values
24) End

III. SOFTWARE DEVELOPMENT

Graphical and analytical synthesis of four bar mechanism is the important phase for the synthesis of four bar mechanism. Analytical method requires lots of calculation and graphical method which requires great drafting skill. One can rapidly solved for the synthesis of four bar mechanism using graphical approach but it take approximate solution of synthesis of four bar mechanism.

To solve this problem and for accurate result of synthesis of four bar mechanism a software is developed which used quick result of performance of given mechanism. Also, the various set of graphical method is used for synthesis of four bar mechanism but it takes lots of time for synthesis.

The language used for programming is 'C-language'. The computer program can be divided into different stages like

Stage 1: a program first enter user name.

Stage 2: taking the input from the user

Stage 3: program to find the inverse of matrix from the input

Stage 4: program to calculate right and left hand dyad

Stage 5: program to find co-ordinates of linkages

Stage 6: program to sketch the basic mechanism

Stage 7: program to find all length linkages at four bar mechanism

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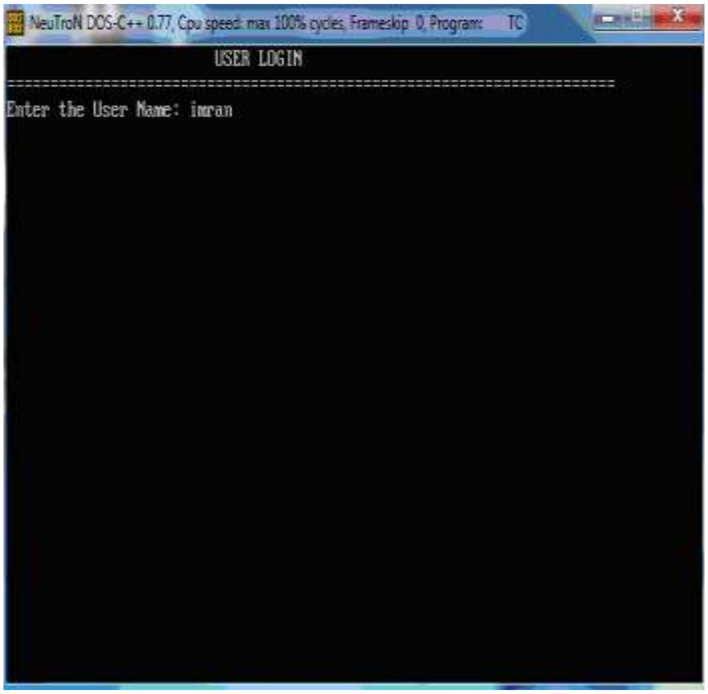

Fig 7.1 User login

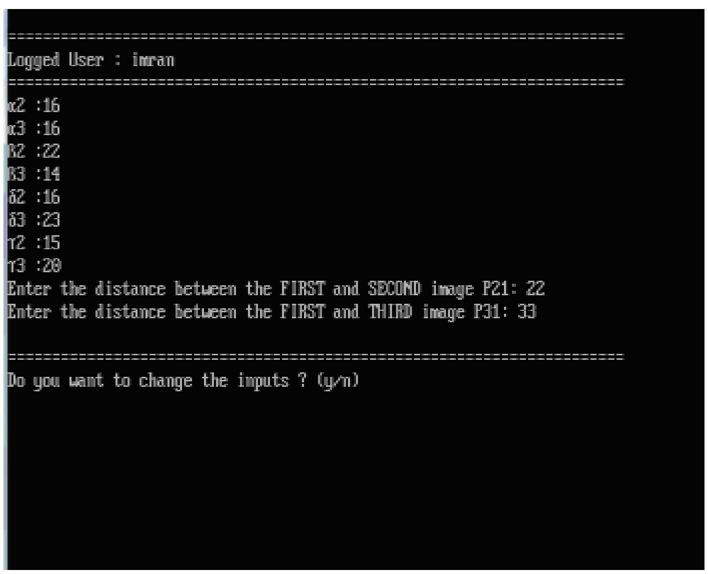

Fig 7.2 Taking user input

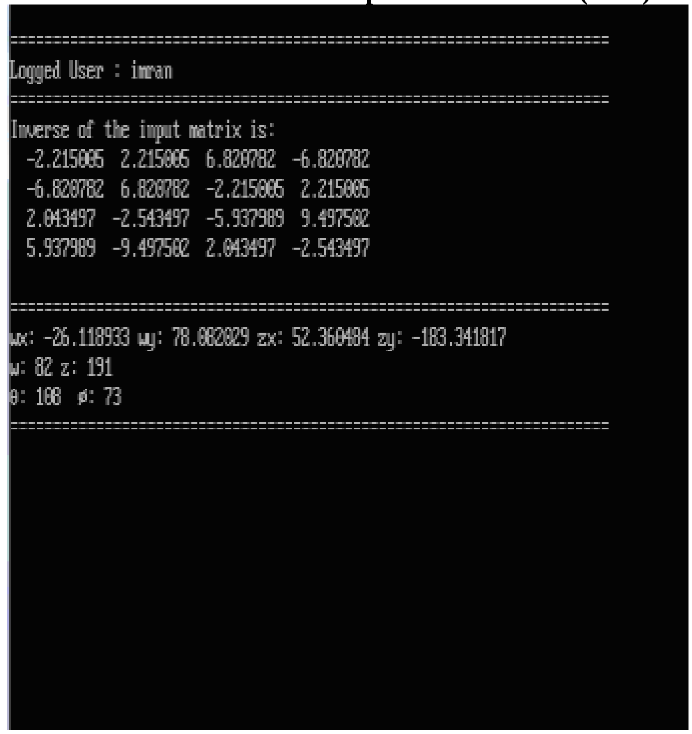

Fig 7.3 Calculating inverse matrix for right dyad

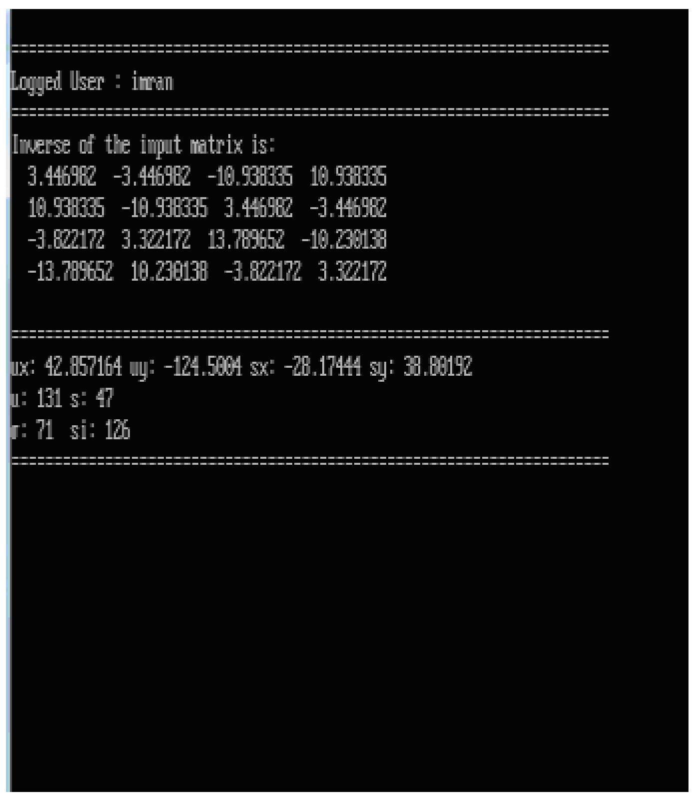

Fig 7.4 Calculating inverse matrix for left dyad

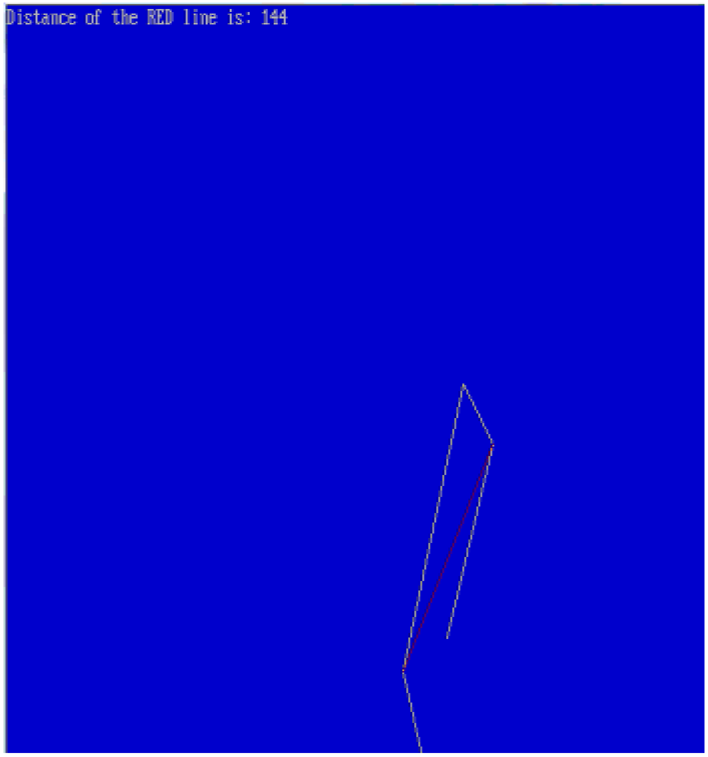

Fig 7.5 Generating the graphical image of four bar mechanism

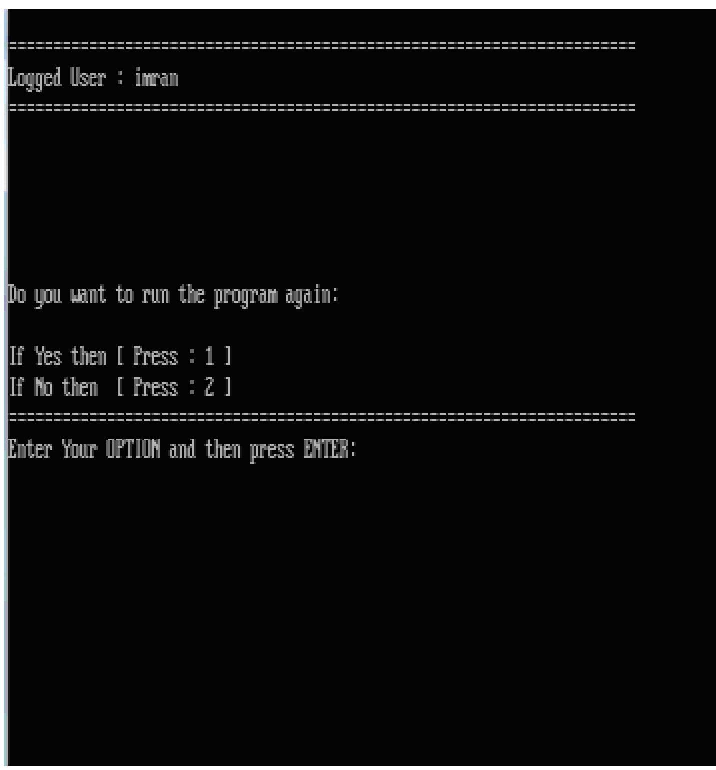

Fig 7.6 Terminating the program

IV. CONCLUSION

In this paper algorithm of synthesis of four bar mechanism is presented. It is shown that this algorithm is based on synthesis of mechanism using three precision points. Synthesis are derived which are based upon rigid body motion generation expressed as a displacement matrix. . A synthesis example is presented illustrating the proposed synthesis technique using any mechanism to guide a rigid body.

V. FUTURE WORK

• Development of software for synthesis of any mechanism.

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