

PLANAR KINEMATICS ANALYSIS METHOD OF STRAIGHT LINE MECHANISM S35 USING VECTOR LOOPS AND VERIFICATION OF RESULTS EXPERIMENTALLY

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ABSTRACT

The calculation method of dynamic reaction forces that happen in the links during one cycle of planar mechanism movements is analyzed in this study. The calculations were done using MathCAD by first solving the kinematic parameters and then solving the kinetostatic parameters. The results were then compared using WorkingModel. The results will show the difference in the results with these two application was -4.57 [%] even though we made sure that we had accuracy of our values to the tenth decimal.

Keywords: Mechanism, movement, kinematics, kinetostatics, etc.

1. INTRODUCTION

The linear mechanism S35 construction problem is presented in Figure 1, where you see that through this mechanism we can get different trajectories.

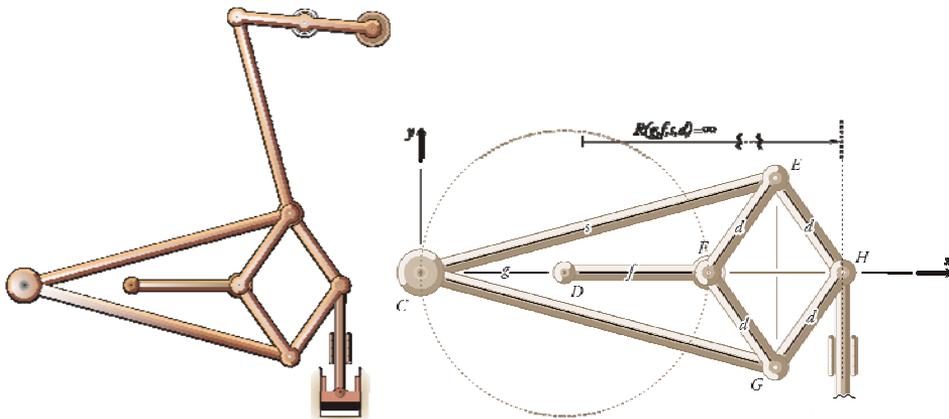


Figure 1. Planar Mechanism S35 PEACELLIER – LIPKIN

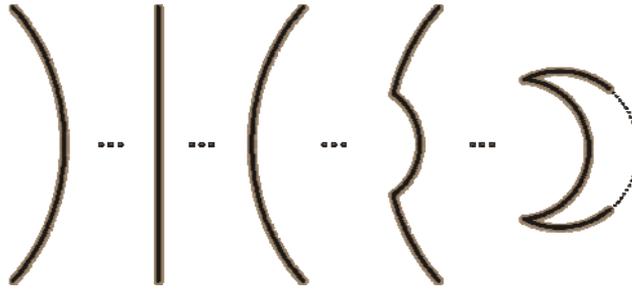
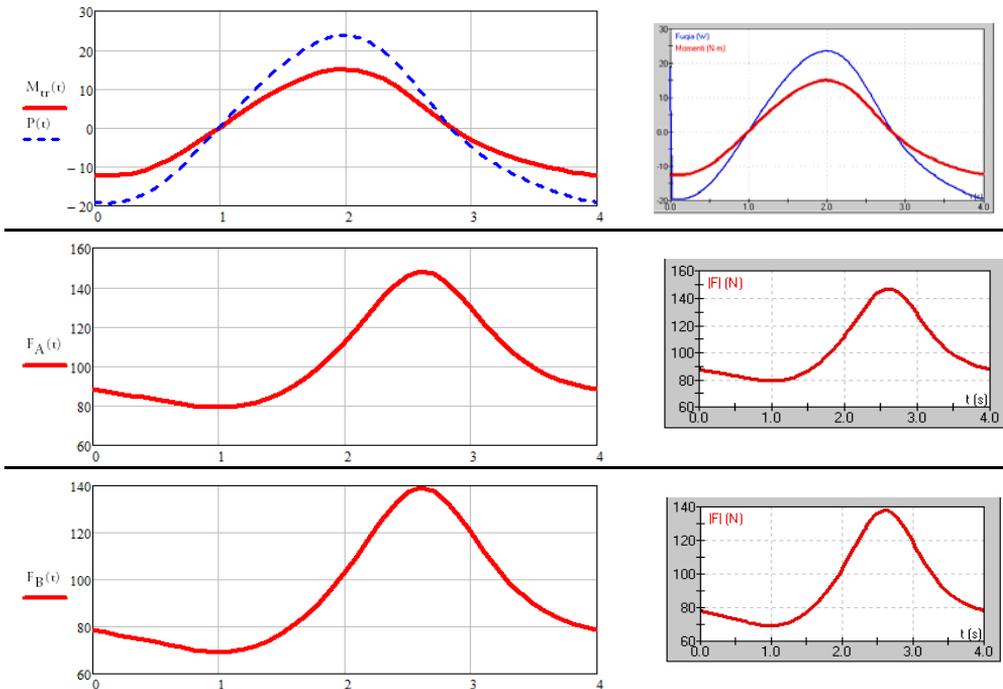


Figure 2. Different trajectories of point H

One can see that the whole mechanism results in movement of point H. Its trajectory can have different forms depending on the dimensions of the mechanism levers. The Kinematics of this mechanism depends on solving the problem using the system of equations with twenty four (24) unknowns.

2. KINETOSTATICS

Kinetostatics problem in solving the system of equations with thirty five (35) unknowns is an ongoing problem in mechanism kinematics and a very difficult one to solve. In this study, we got the results by solving the matrix using Cramer's method. This method is compatible with MathCAD using the Matrix of the order 35x35 elements, respectively 1225 elements.



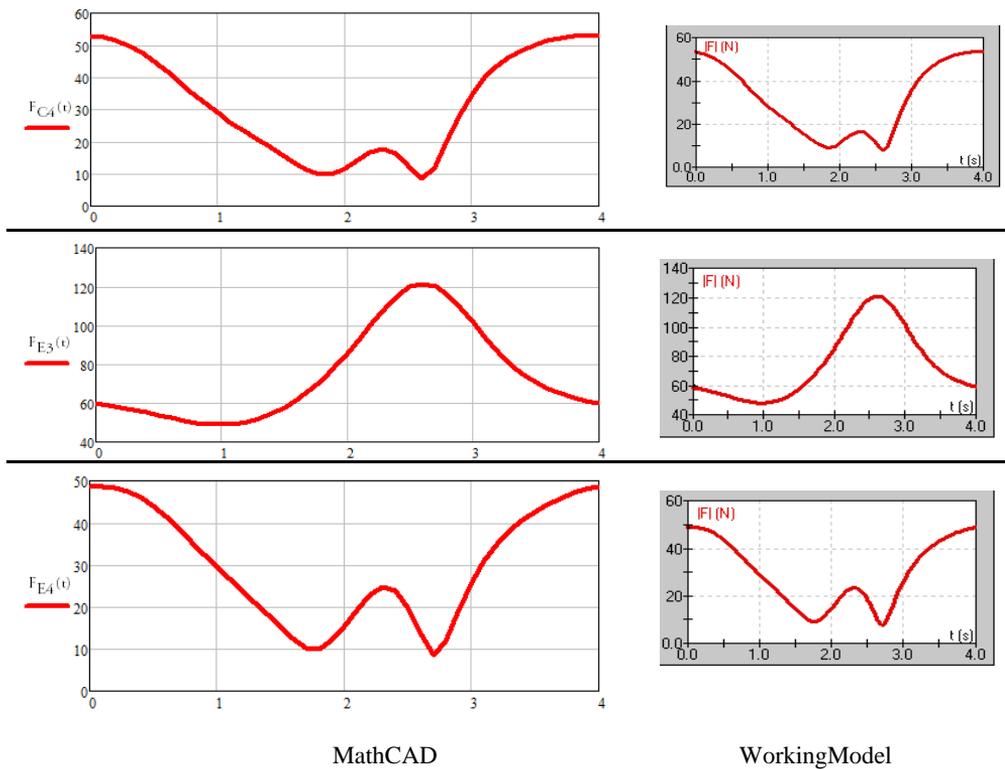


Figure 3. Resulting diagrams using MathCAD and WorkingModel

After solving the unknowns, we get the values for only four positions during one cycle of the mechanism. The values then are compared using WorkingModel, as shown in Table 1.

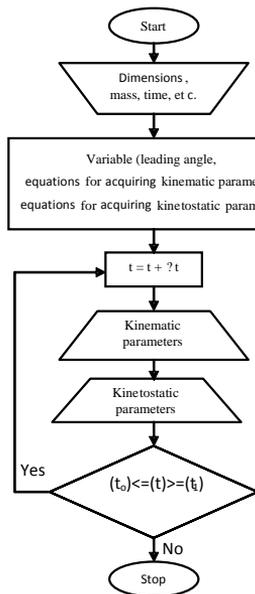


Figure 4. Resulting diagrams using MathCAD and WorkingModel

Table 1. The values for four position using MathCAD and Working Model applications

	MathCAD				Working Model			
	1 [s]	2 [s]	3 [s]	4 [s]	1 [s]	2 [s]	3 [s]	4 [s]
M_{tr} [Nm]	0.25315	15.0529	-3.12467	-12.20706	0.24914	15.03555	-3.09966	-12.20533
P [W]	0.39765	23.64504	-4.90822	-19.17481	0.39135	23.61779	-4.86893	-19.17209
F_A [N]	79.29558	112.1349	129.46946	88.17943	79.51267	111.95017	129.09618	88.14300
F_B [N]	69.30647	103.05501	119.98321	78.65264	69.52346	102.86461	119.60856	78.61295
F_C [N]	28.84608	11.67802	34.80728	52.9919	29.16248	11.34363	35.63764	53.17462
F_E [N]	29.52396	15.44196	25.91642	48.4645	29.84083	14.98081	26.73179	48.64663

The result show that the difference in the calculated values in MathCAD versus WorkingModel is around 4.57 [%].

3. CONCLUSION AND RECOMMENDATIONS

While being respectful of the current information technology, we described generally the method of solving the algorithm using both softwares, MathCAD and WorkingModel.

Using these different softwares, we found out that the difference in the results was -4.57 [%] even though we made sure that we had accuracy of our values to the tenth decimal.

The timing was an important element not only in the way the problem had to be presented but also the time it takes to get the results. Using a computer with these configurations: RAM 1.5 Gb, CPU Core2Duo 2.0 GHz, it took MathCAD to solve the problem about eighteen (18) hours and it took WorkingModel about four (4) seconds, making the difference in timing very clear, about 6479 [%]. Thus, we can comfortably say that the general difference in the results and the time difference using these two different softwares is about 2159.86821 [%].

4. REFERENCES

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