SUMMER INTERNSHIP PROJECT REPORT 2

KINEMATIC ANALYSIS OF THE GEARED FIVE BAR LINKAGE

DRDO, GTRE

GAS TURBINE RESEARCH ESTABLISHMENT

RSIF, Gearbox Division

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Problem Definition

Problem (4-16) (pg-206): The link lengths (mm), gear ratio, phase angle and value of θ_2 (deg) for some geared five bar linkages are defined in the Table given. The linkage configuration and terminology are also given. For the rows (cases) assigned, draw the linkages to scale and graphically find all possible solutions for the angles θ_3 and θ_4.

Problem (4-17) (pg0-206): Repeat the problem, except solve by the Vector loop method.

Problem (6-10) (pg-311): The linkage configuration and terminology are given. The link lengths (mm), gear ratio, phase angle and value of θ_2 (deg) and ω_2 (rad/s) are defined. For the rows (cases) assigned, draw the linkages to scale and graphically find all possible solutions for the angular velocities ω_3 and ω_4.

Problem (6-11) (pg0-312): Repeat the problem, except solve using analytical method.

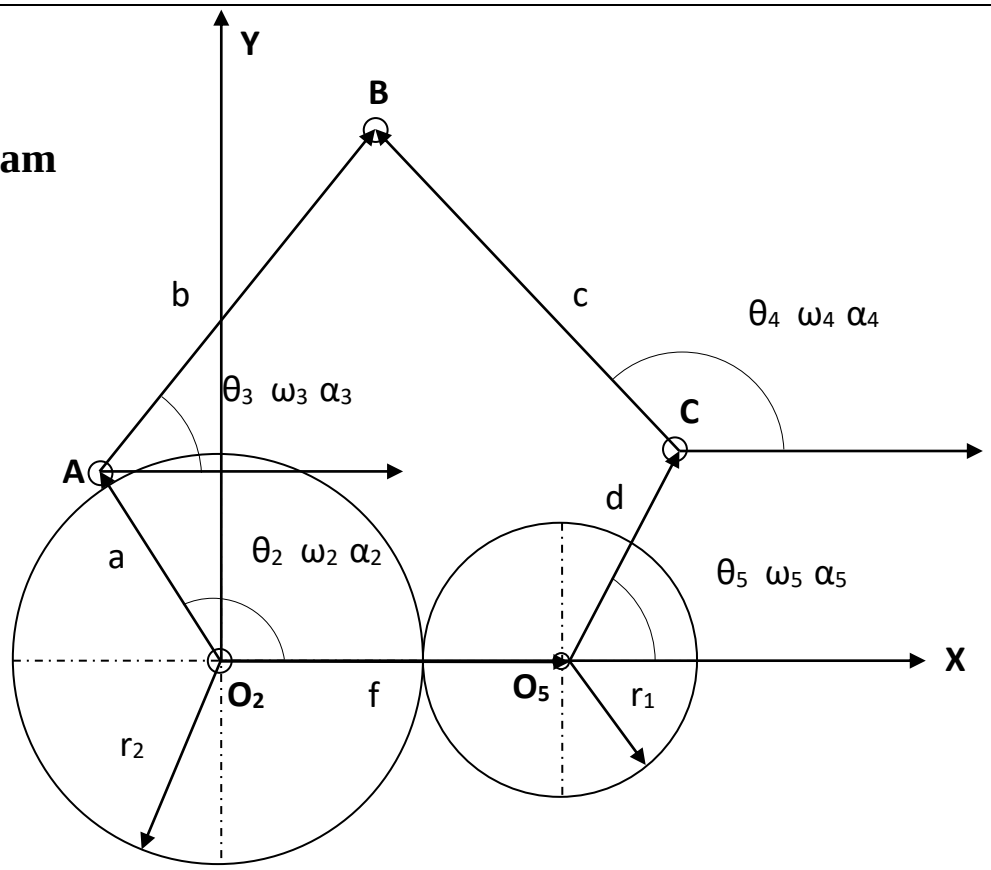
Problem (7-9) (pg-358): The linkage configuration and terminology are given. The link lengths (mm), gear ratio, phase angle and value of θ_2 (deg), ω_2 (rad/s) and α_2 (rad/s^2) are defined. For the rows (cases) assigned, draw the linkages to scale and graphically find all possible solutions for the angular velocities α_3 and α_4.

Table

link a	link b	link c	link d	link f	Gear ratio	Phase	θ2	ω2	α2
25.4	177.8	228.6	101.6	152.4	2	30	60	10	0
127	177.8	203.2	101.6	152.4	-2.5	60	30	-12	5
127	177.8	203.2	101.6	76.2	-0.5	0	45	-15	-10
127	177.8	203.2	101.6	101.6	-1	120	75	24	-4
228.6	279.4	203.2	203.2	127	3.2	-50	-39	-50	10
50.8	177.8	127	76.2	254	1.5	30	120	-45	50
177.8	228.6	279.4	101.6	381	2.5	-90	75	100	18
203.2	177.8	228.6	101.6	304.8	-2.5	60	55	-65	25
177.8	203.2	228.6	101.6	228.6	-4	120	100	25	-25

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Diagram



Solution

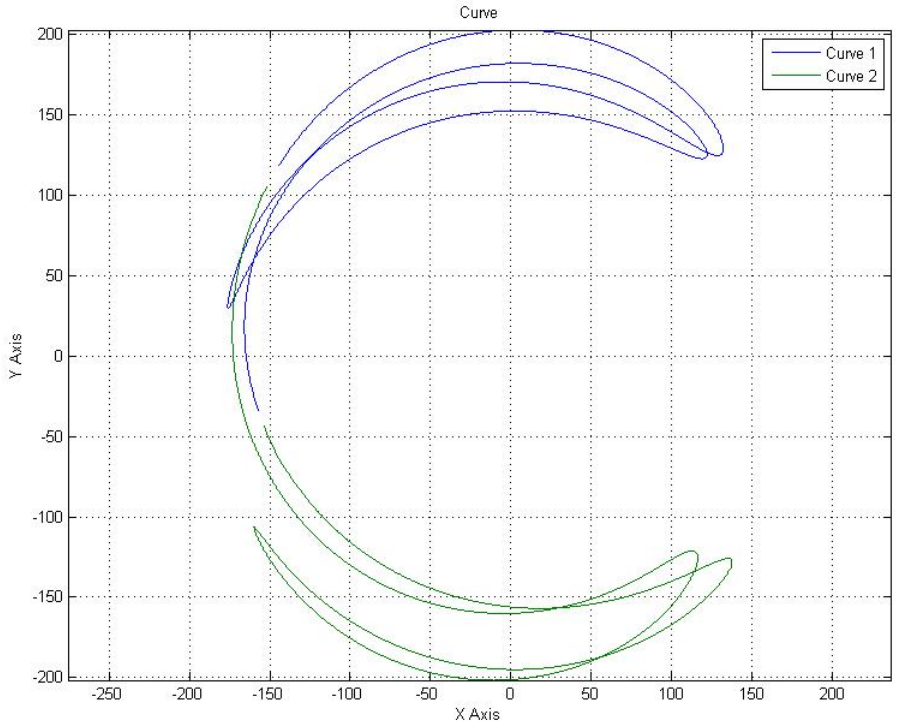
MATLAB was use to generate the code and find the solution to the above problem.

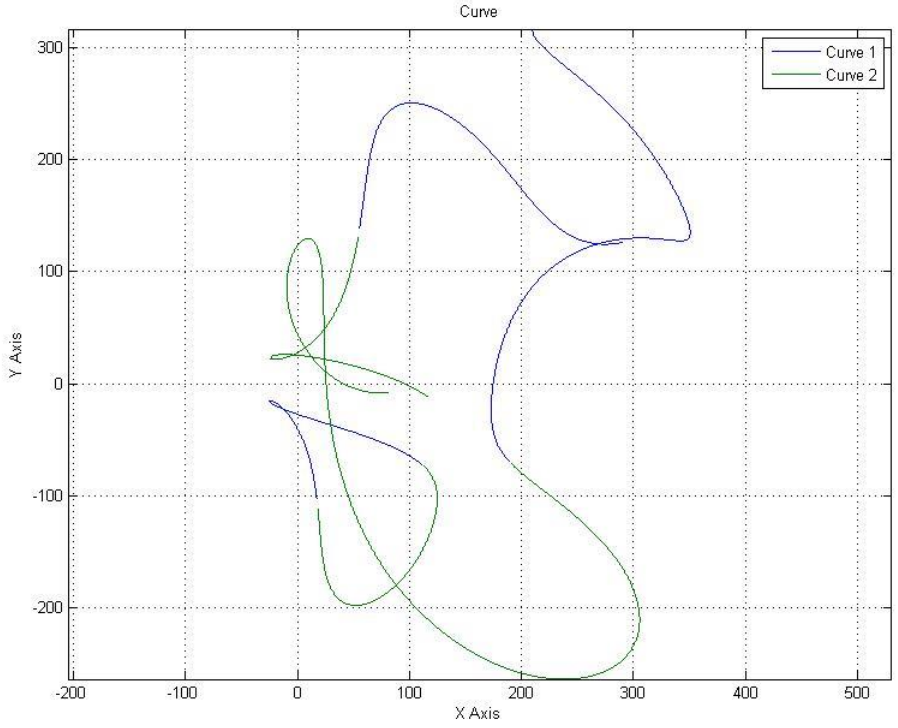
OPEN								
θ3	**ω3**	**α3**	**θ4**	**ω4**	**α4**	**θ5**	**ω5**	**α3**
173.6420808	32.58479813	3191.23368	-177.7151939	16.94777004	2492.42117	150	20	0
39.61603327	30.67980149	548.7550473	91.01155514	17.25229813	592.3686348	-15	30	-12.5
17.64949167	10.73070073	313.7332982	63.97170476	-2.612209709	271.5111024	-22.5	7.5	5
56.33390745	-26.95416576	959.3800171	101.9309955	3.418731192	962.1203771	45	-24	4
-163.9684979	-158.3477533	2171.49476	-94.37894611	-81.26435816	5803.002881	-174.8	-160	32
12.50544298	25.84357843	247.5393965	108.2762658	-29.49179792	3392.166494	210	-67.5	75
44.23475525	-8.897384578	-22064.14664	124.4198032	-40.90302194	-8453.52419	97.5	250	45
-13.02086291	61.68259581	18217.75757	99.31739197	12.53777129	-630.7553269	-77.5	162.5	-62.5
37.08166674	-40.12041674	-5697.461059	120.2054158	47.92190341	-1868.806486	-280	-100	100

CROSSED					
θ3	**ω3**	**α3**	**θ4**	**ω4**	**α4**
-115.4073608	-75.19089915	-6648.463007	-124.050086	-59.55387106	-18315.04901
-104.7632031	12.58117374	475.9262838	-156.1587249	26.0086771	-936.5449376
-133.7434186	-8.22593314	87.14901347	179.9343683	5.116977303	65.53225384
-96.09366111	16.57338276	37.06053216	-141.6907492	-13.79951419	-403.023198
111.224381	-116.8064184	7781.003703	41.63482915	-193.8898136	-46008.28019
-54.58690042	-13.10391526	3271.284682	-150.3577233	42.23146109	-1424.043549
-69.12850238	-48.51219714	-5529.279399	-149.3135503	-16.50655979	-19443.99573
-90.26046811	3.69724867	-4373.410426	157.401277	52.84207319	12703.13045
-67.38585336	59.63703088	-2593.235453	-150.5096025	-28.40528926	-7288.337257

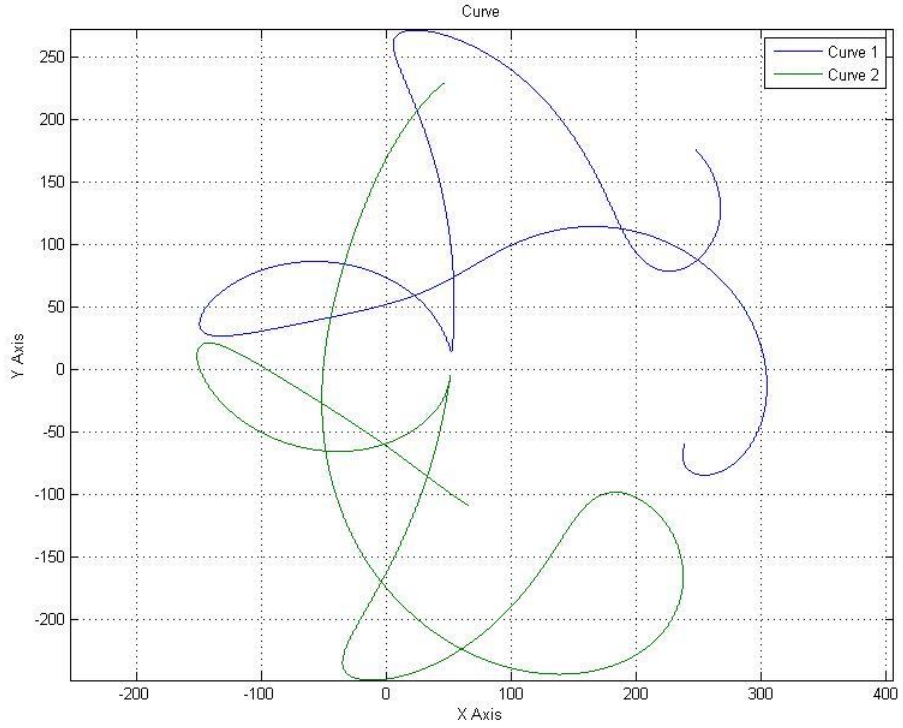
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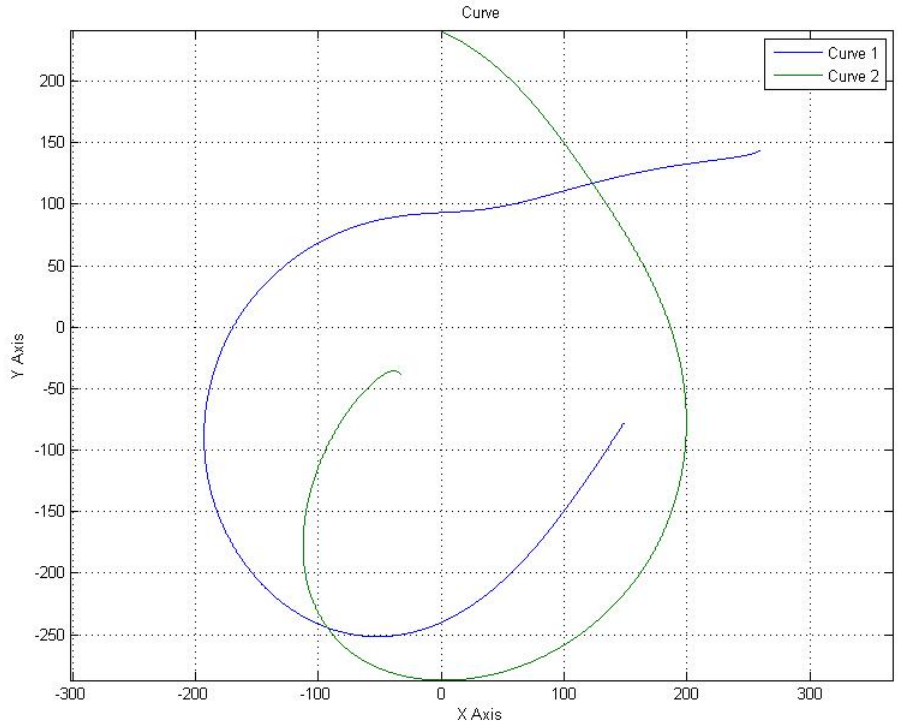
Images (curves)



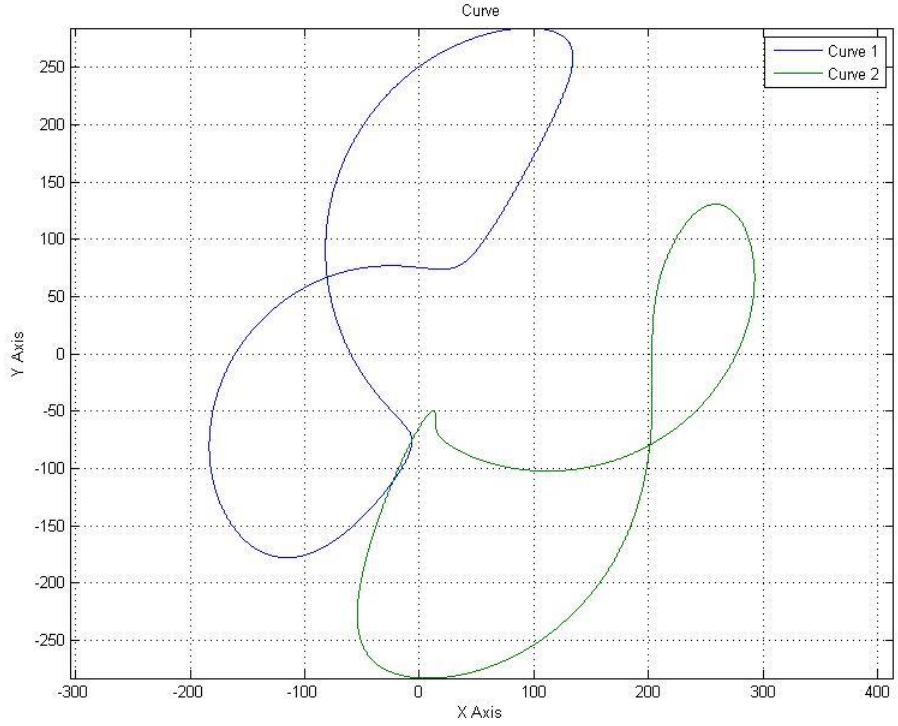


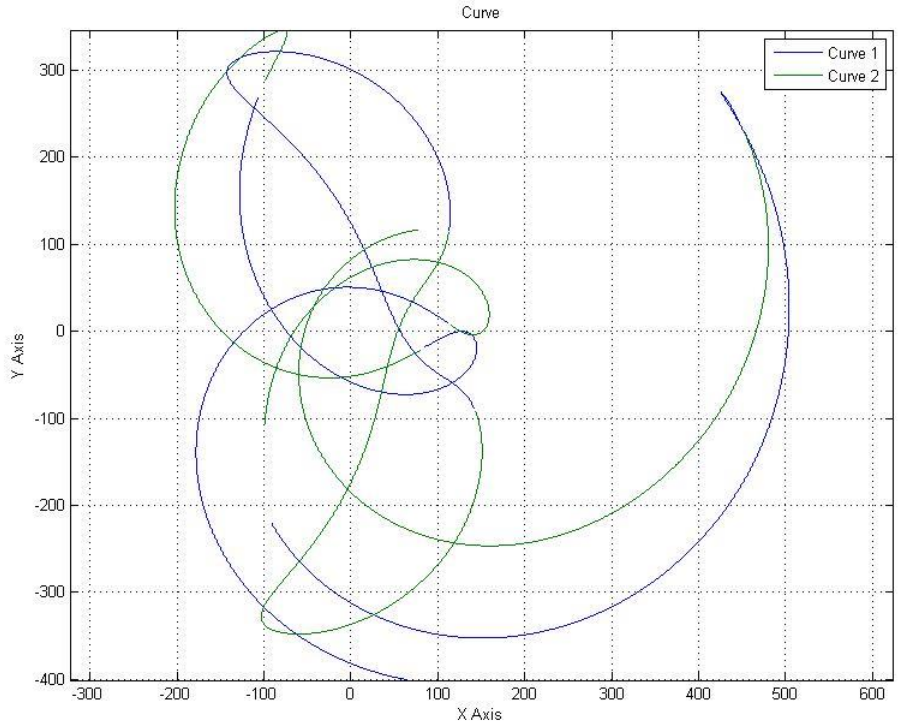
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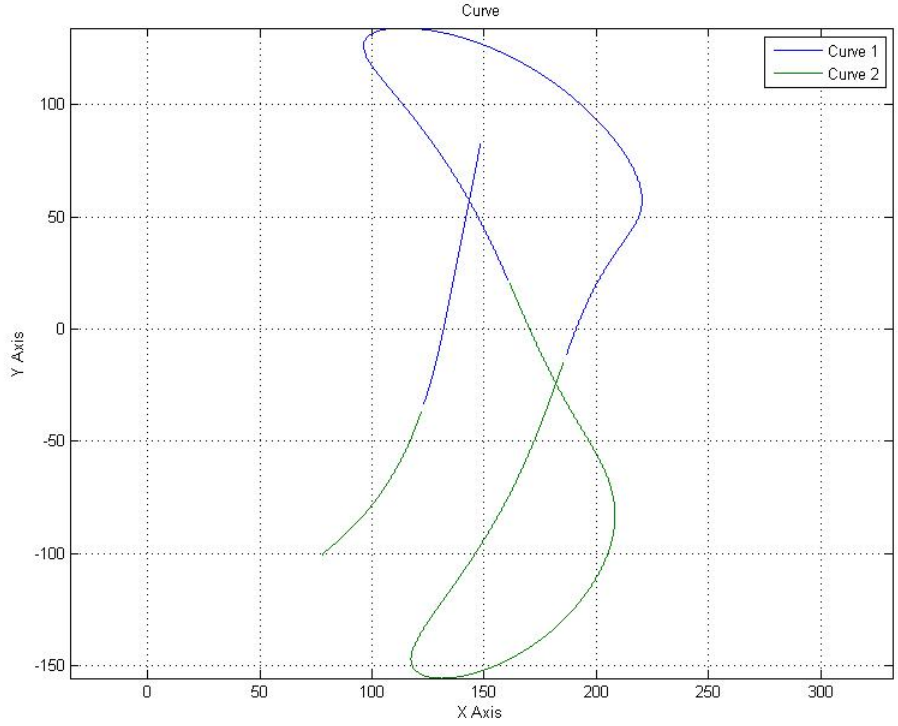


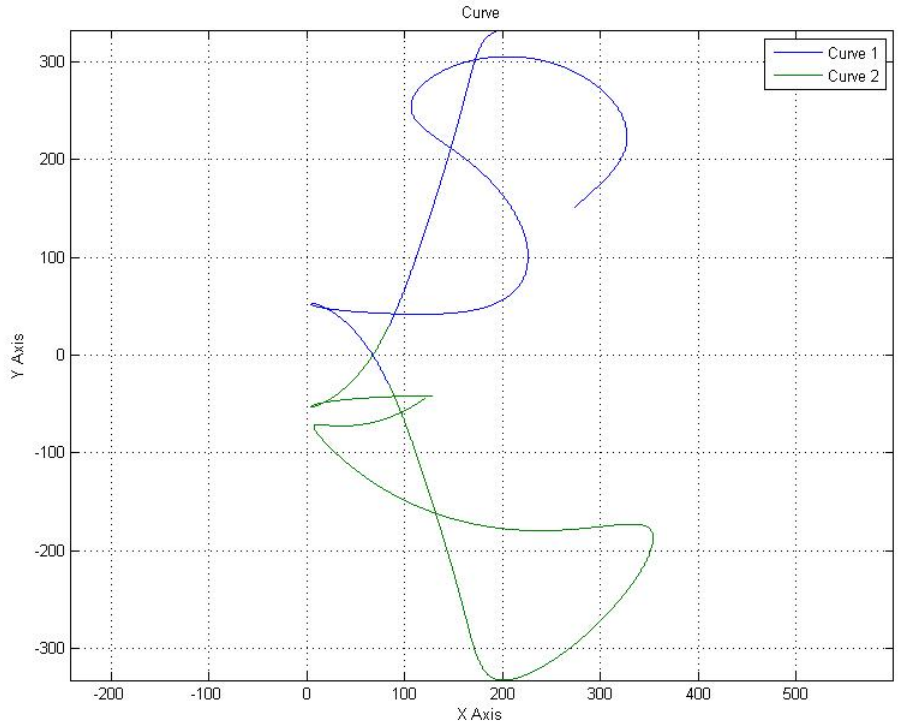
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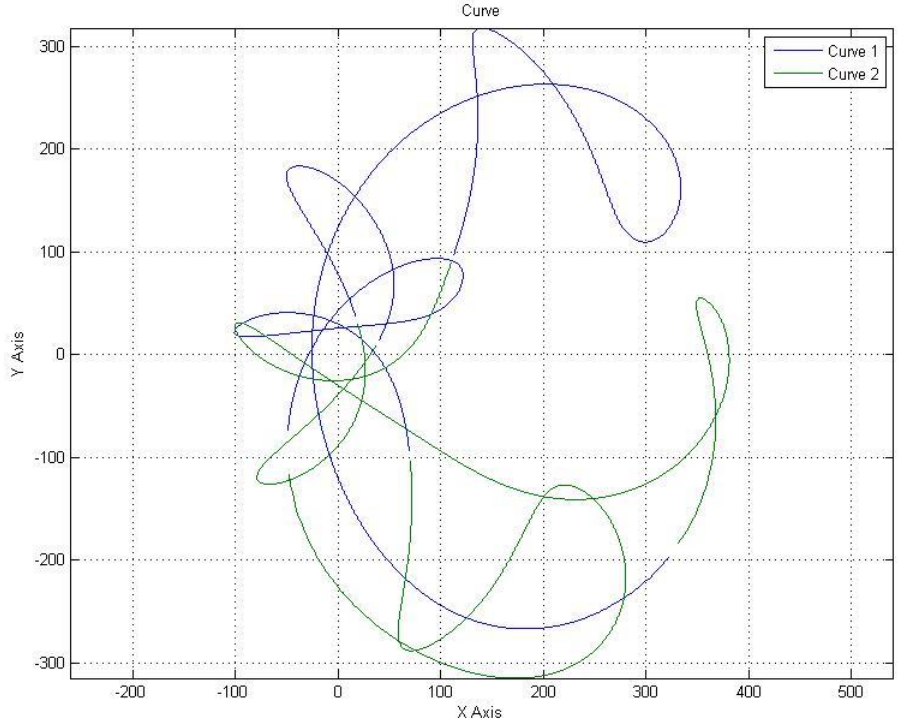


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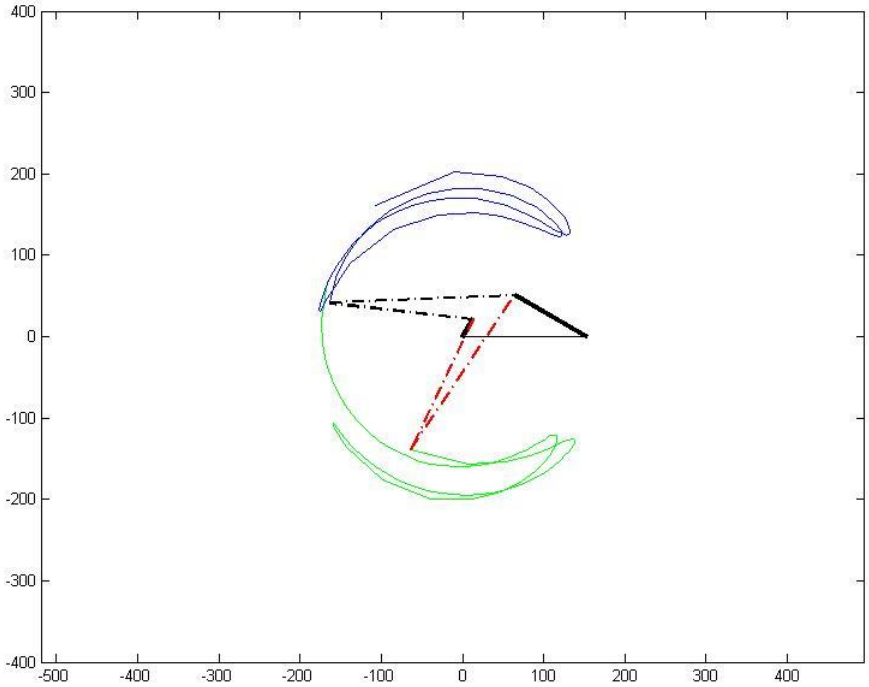




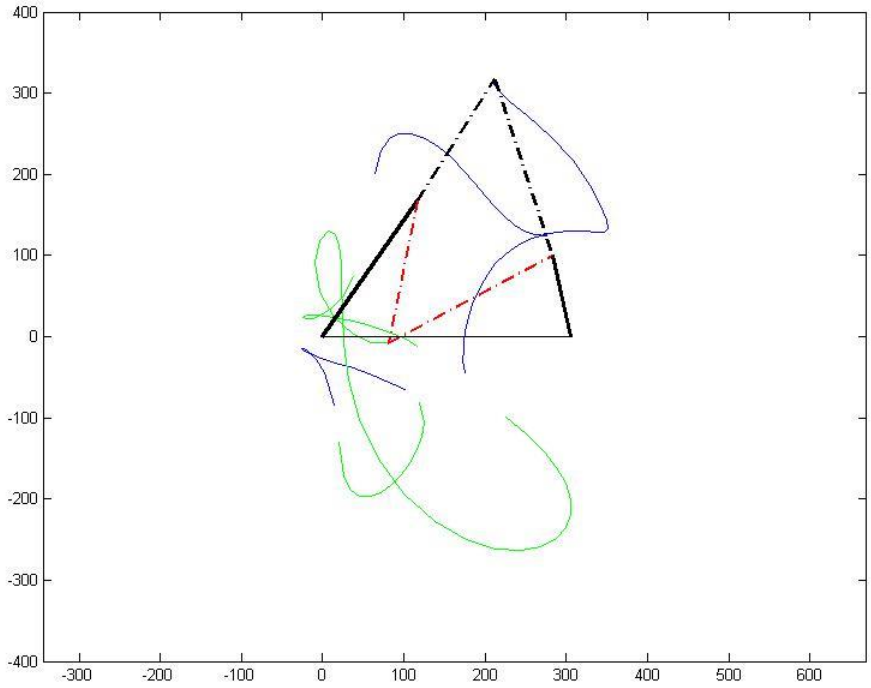
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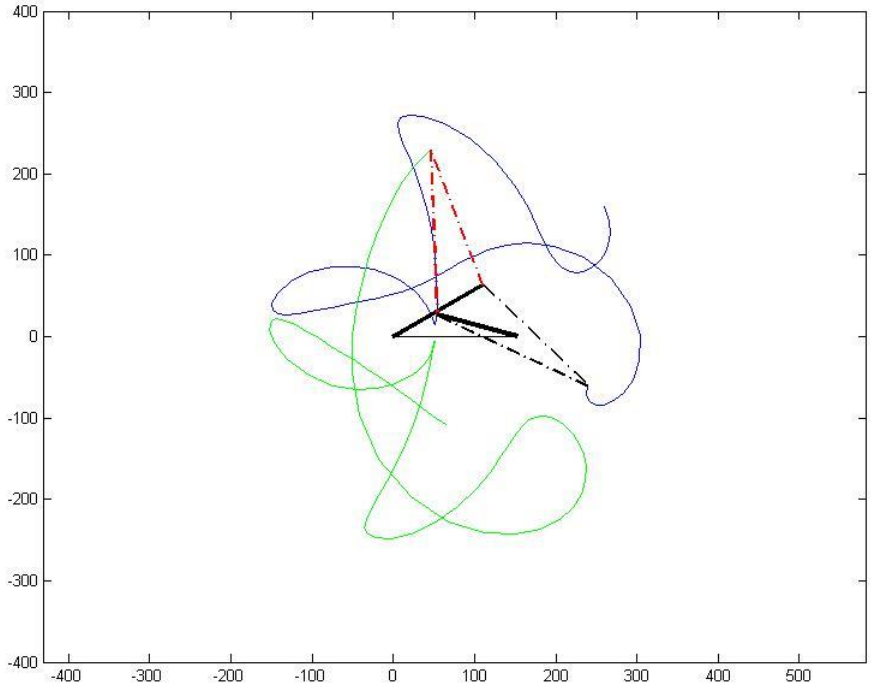


Linkages (with Curves)

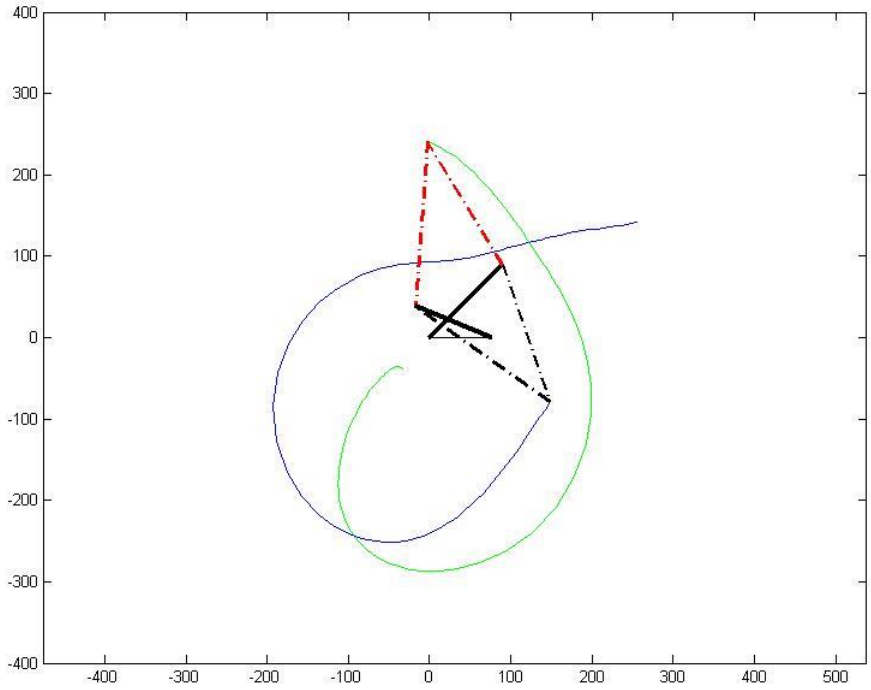


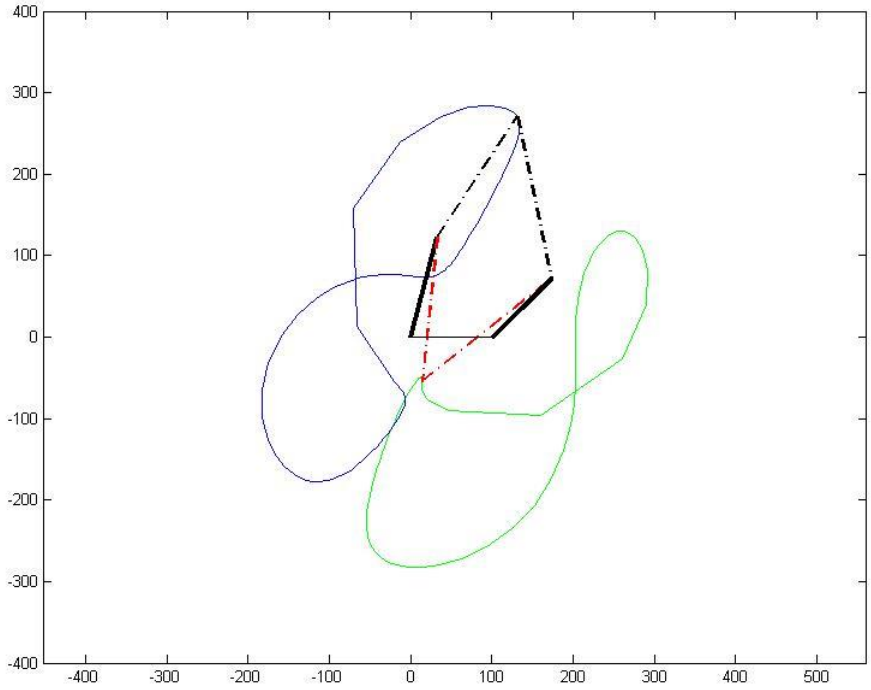
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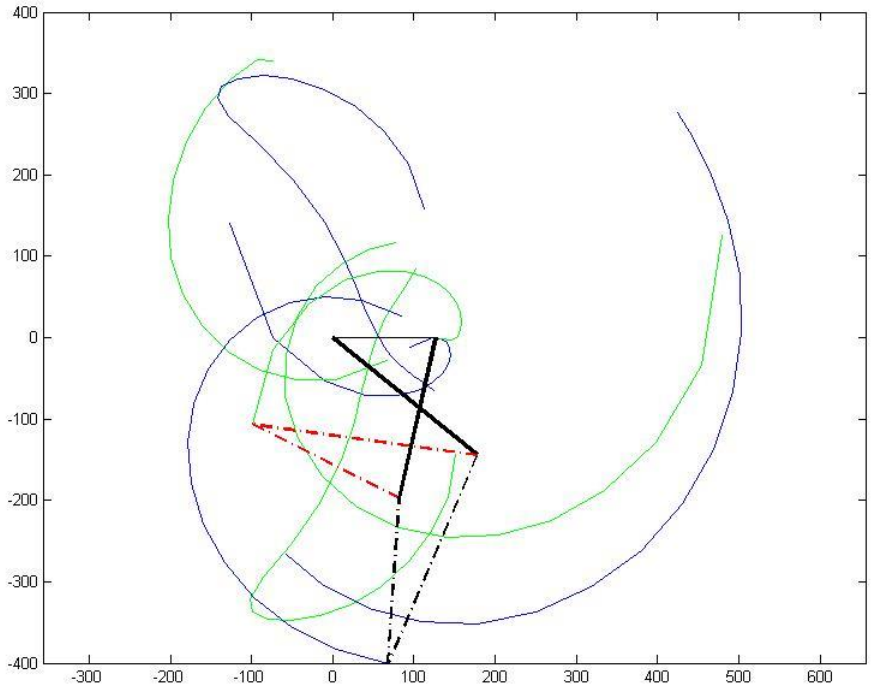


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MATLAB CODE

The generated code is attached with the folder.

program.m: gives the solution to the angular velocities and accelerations.

allcurve.m: gives the locus curve of the point B.

cometcurve.m: gives the locus animation of the point B.

Animation.m: gives the animations of the linkage motion.

References

1. Matlab 2010b.
2. 'Kinematics and Dynamic of Machinery' RL Norton.

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