FIGURE P11-1

Linkage geometry and free body diagrams for problems 11-3 to 11-4

*11-3   Table P11-1 shows kinematic and geometric data for several slider-crank linkages of the type and orientation shown in Figure P11-1.   The point locations are defined as described in the text.   For the row(s) in the table assigned, use the matrix method of Section 11.5 (p. 576) and program MATRIX, *Mathcad*, *Matlab*, *TKSolver*, or a matrix solving calculator to solve for forces and torques at the position shown.   Also compute the shaking force and shaking torque.   Consider the coefficient of friction μ between slider and ground to be zero.   You may check your solution by opening the solution files (located in the Solutions folder on the CD-ROM) named P11-03x (where x is the row letter) into program SLIDER.

*†11-4   Repeat Problem 11-3 using the method of virtual work to solve for the input torque on link 2.   Additional data for corresponding rows are given in Table P11-2.

Tables P11-1 and P11-2 are on the next page

* Answers in Appendix F.

TABLE P11-1 Data for Problem 11-3 (See Figure P11-1 for Nomenclature)

Part 1   Lengths in inches, angles in degrees, mass in blobs, angular velocity in rad/sec

Row	link 2	link 3	offset	θ_2	ω_2	α_2	m_2	m_3	m_4
a.	4	12	0	45	10	20	0.002	0.020	0.060
b.	3	10	1	30	15	− 5	0.050	0.100	0.200
c.	5	15	-1	260	20	15	0.010	0.020	0.030
d.	6	20	1	− 75	−10	− 10	0.006	0.150	0.050
e.	2	8	0	135	25	25	0.001	0.004	0.014
f.	10	35	2	120	5	− 20	0.150	0.300	0.050
g.	7	25	-2	− 45	30	− 15	0.080	0.200	0.100

Part 2   Angular acceleration in rad/sec², moments of Inertia in blob-in², torque in lb-in

Row	I_2	I_3	Rg_2 mag	δ_2 ang	Rg_3 mag	δ_3 ang	FP_3 mag	δFP_3 ang	RP_3 mag	δRP_3 ang	T_3
a.	0.10	0.2	2	0	5	0	0	0	0	0	20
b.	0.20	0.4	1	20	4	− 30	10	45	4	30	− 35
c.	0.05	0.1	3	− 40	9	50	32	270	0	0	− 65
d.	0.12	0.3	3	120	12	60	15	180	2	60	− 12
e.	0.30	0.8	0.5	30	3	75	6	− 60	2	75	40
f.	0.24	0.6	6	45	15	135	25	270	0	0	− 75
g.	0.45	0.9	4	− 45	10	225	9	120	5	45	− 90

Part 3   Forces in lb, linear accelerations in inches/sec²

Row	θ_3	α_3	ag_2 mag	ag_2 ang	ag_3 mag	ag_3 ang	ag_4 mag	ag_4 ang
a.	166.40	− 2.40	203.96	213.69	371.08	200.84	357.17	180
b.	177.13	34.33	225.06	231.27	589.43	200.05	711.97	180
c.	195.17	−134.76	1 200.84	37.85	2 088.04	43.43	929.12	0
d.	199.86	− 29.74	301.50	230.71	511.74	74.52	23.97	180
e.	169.82	113.12	312.75	−17.29	976.79	−58.13	849.76	0
f.	169.03	3.29	192.09	23.66	302.50	−29.93	301.92	0
g.	186.78	− 172.20	3 600.50	90.95	8 052.35	134.66	4 909.27	180

TABLE P11-2 Data for Problem 11-4

See also Table P11-1. Unit system is the same as in that table.

Row	ω_3	Vg_2 mag	Vg_2 ang	Vg_3 mag	Vg_3 ang	Vg_4 mag	Vg_4 ang	VP_3 mag	VP_3 ang
a.	− 2.43	20.0	135	35.24	152.09	35.14	180	35.24	152.09
b.	− 3.90	15.0	140	40.35	140.14	24.45	180	26.69	153.35
c.	1.20	60.0	310	89.61	−8.23	93.77	0	89.61	− 8.23
d.	0.83	30.0	315	69.10	191.15	63.57	180	70.63	191.01
e.	4.49	12.5	255	56.02	211.93	29.01	180	61.36	204.87
f.	0.73	30.0	255	60.89	210.72	38.46	180	60.89	210.72
g.	−5.98	120.0	0	211.46	61.31	166.14	0	208.60	53.19