Satisfy the path of a coupler point K

System-Input: Crank motion **System-Output:** Path of K

General Description

Given is a **path of points** in the x-y-plane as shown in Fig. 1 and Tab. 1. It belongs to a production machine, where point K of a link carries a glue tool which pastes glue to an object along the given path from point 6 to point 20 (bold values). The tangential velocity at these points should be approximately equal to the value vK = 10 cm/s. Points 1 through 5 and points 21 through 25 may not necessarily have to follow the given path.- i.e. the points for which the tool is not in contact with the object.

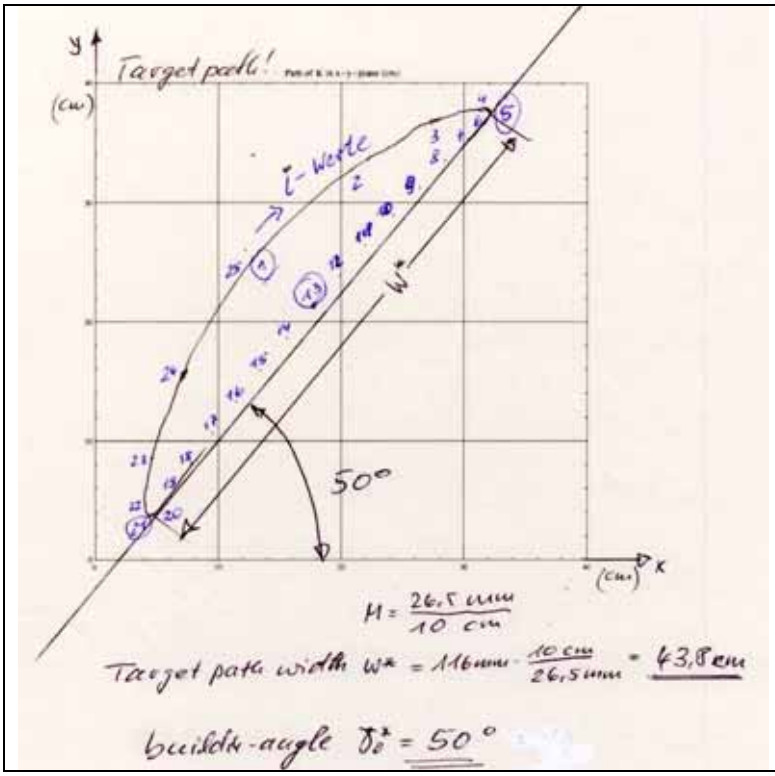


Fig 1: Path of K in x-y plane.

i	xK (cm)	yK (cm)	φ (°)
1	12.7628	25.1055	0
2	20.7399	32.6973	15
3	27.3176	36.5655	30
4	30.9341	37.8159	45
5	32.0957	37.6897	60
6	**31.6679**	**36.7791**	**75**
7	**30.3086**	**35.3329**	
8	**28.4475**	**33.4829**	
9	**26.3496**	**31.3294**	
10	**24.1674**	**28.9627**	
11	**21.9762**	**26.4618**	
12	**19.8028**	**23.8869**	
13	**17.6504**	**21.2745**	**180**
14	**15.5207**	**18.6395**	
15	**13.4293**	**15.9855**	
16	**11.4129**	**13.3229**	
17	**9.52659**	**10.6904**	
18	**7.83368**	**8.17832**	
19	**6.39239**	**5.95546**	
20	**5.24695**	**4.30326**	**285**
21	4.43788	3.67085	300
22	4.07219	4.755	
23	4.54943	8.52745	
24	6.9778	15.743	
25	12.7628	25.1055	360

Tab. 1: xK and yK values of K and φ .

Problem 1:

For the described task please find a **crank rocker mechanism** with coupler point K that satisfies the given path as well as possible. Locate the mechanism in the x-y-Plane of the production machine.

Problem 2:

For the described task please find a **crank shaper mechanism** with coupler point K that satisfies the given path as well as possible. Locate the mechanism in the x-y-Plane of the production machine.

Solution

1) Overview

np is given by the related mechanism, nR is found due to the list of points of K: here 2 x 25 and the general message φinit = 0. So nR = 51.

2) Graphical - fist - solution based on less of points, see next pages.

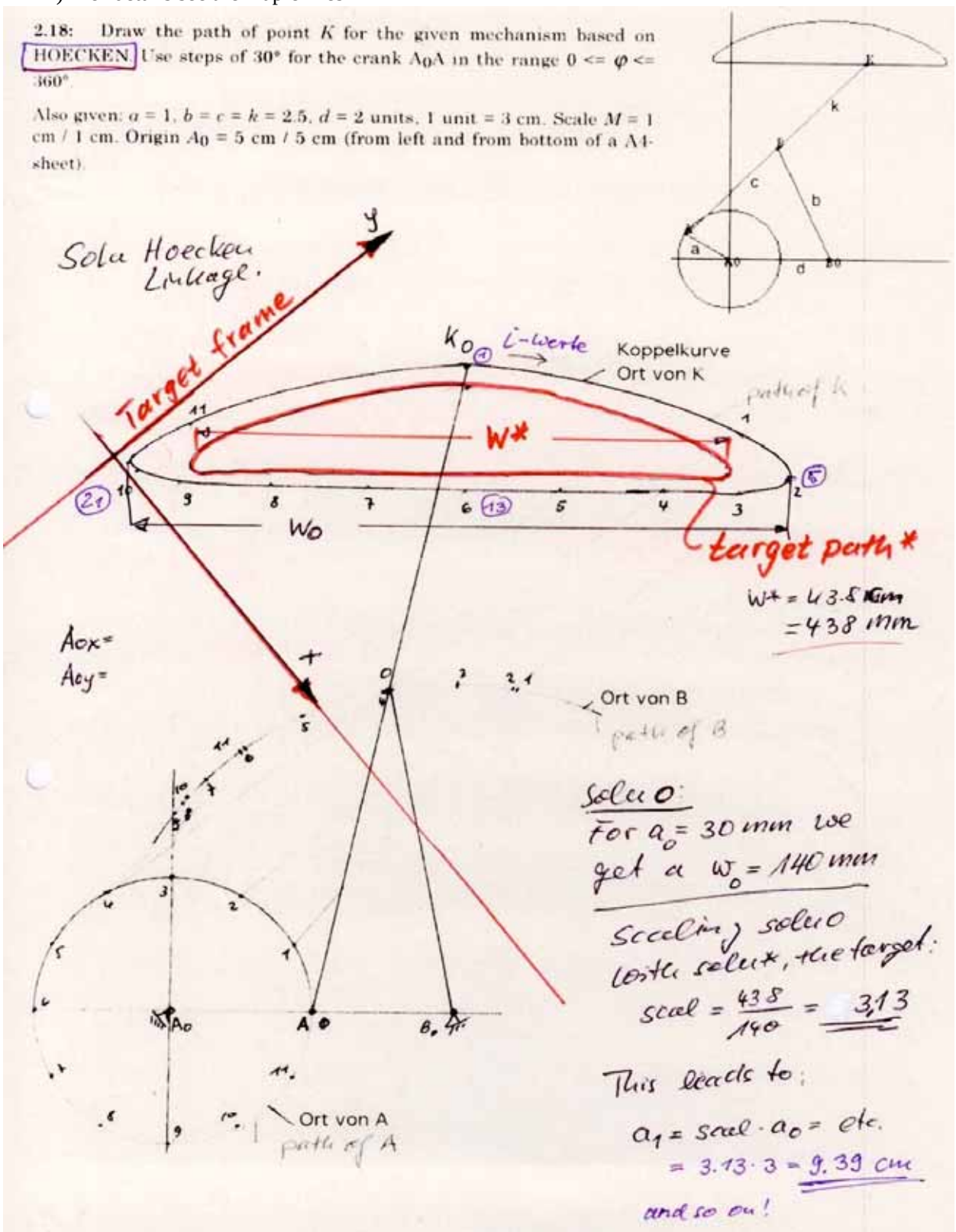
3) Numerical - second - solution (optimisation method), see Maple files

4) Post evaluations of all functions, see Maple files

5) Computation of velocity of point K and (const.) angular velocity of input crank, , see Maple files

6) Computation of a input torque due to a tang. force Fg = 8 N at K, , see Maple files

2 - P1) - for details see the maple files

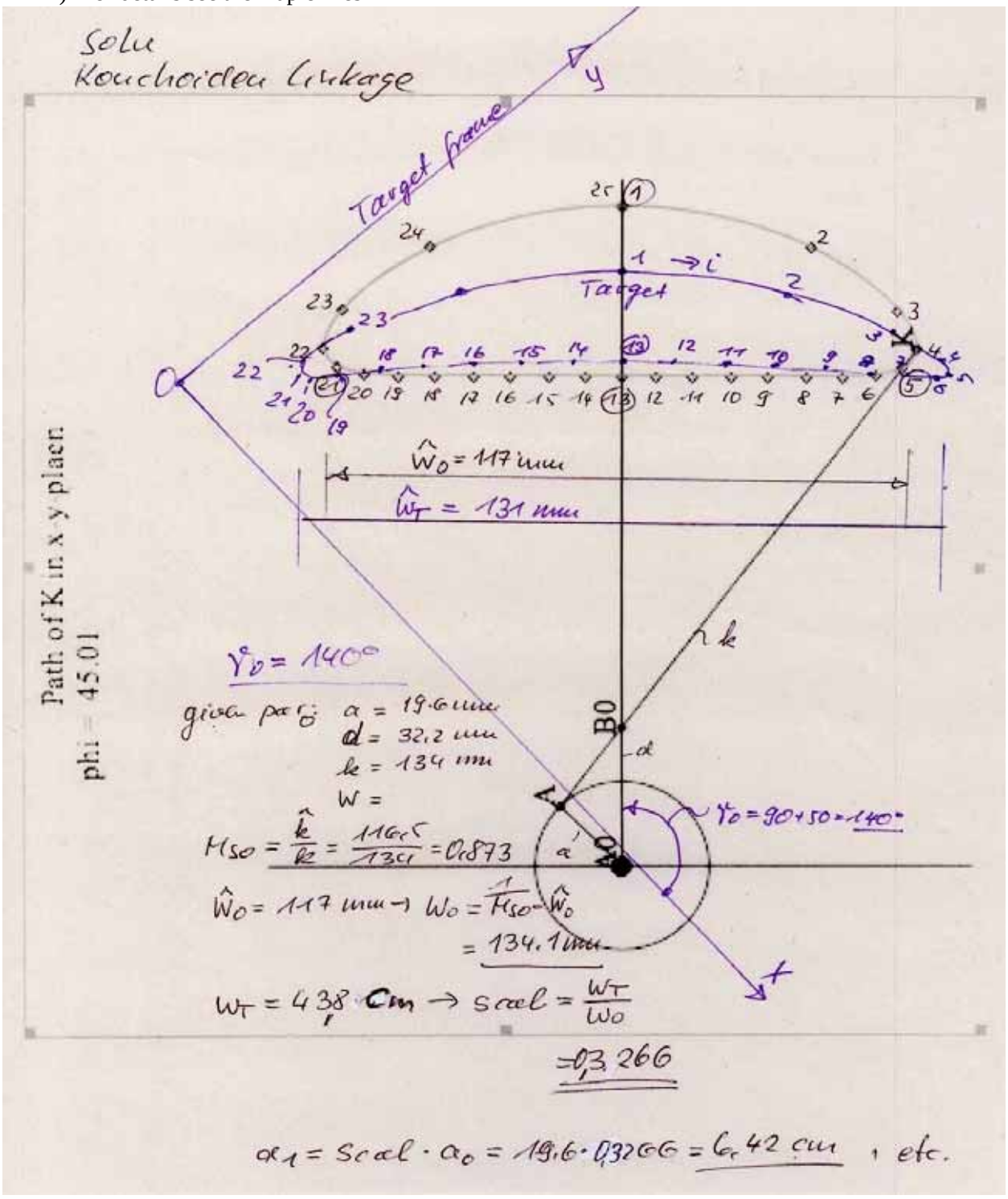


parsolu1 = [a = 9.385714287, b = 23.46428572, c = 23.46428572, d = 18.77142857, k = 46.92857144, kappa = 0, gamma_0 = (5/18)*Pi, A0x = 34.99530614, A0y = -18.14571429];

For the optimisation, the points := [1, 5, 7, 9, 11, 13, 15, 21] are use:

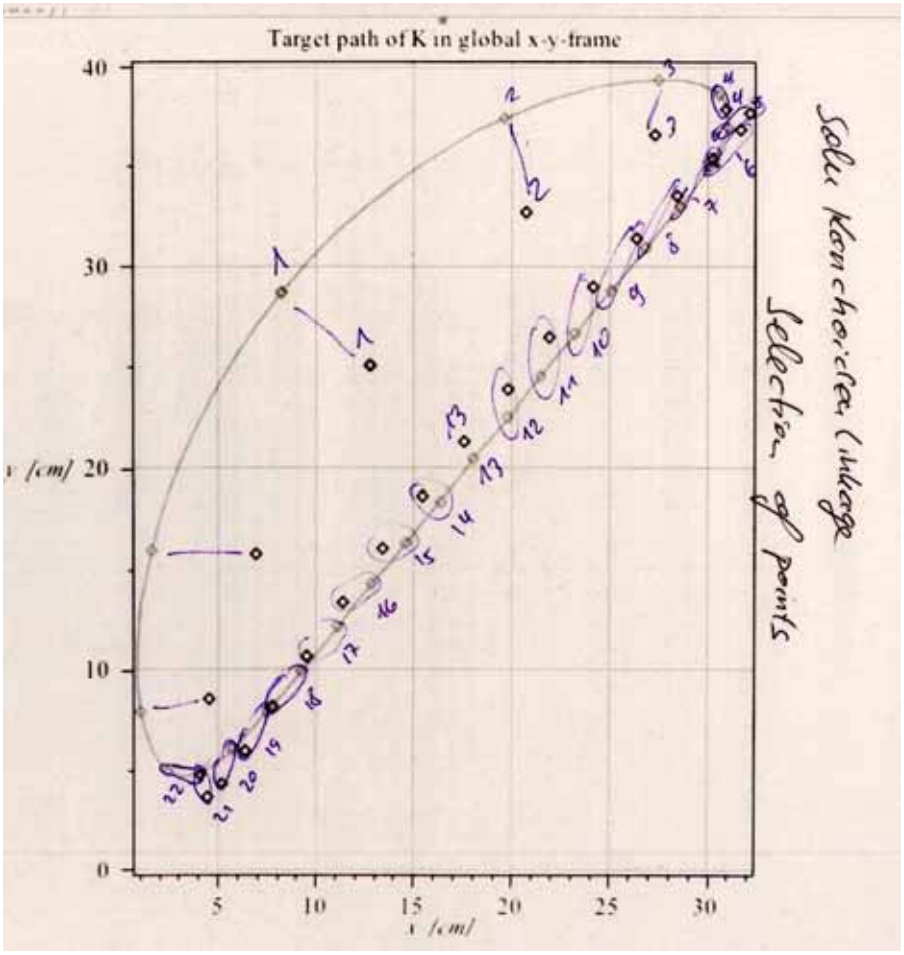
parsolu2 = [A0x = 36.7418321560852519, A0y = -17.8919414632885534, a = 8.76450507026510550, b = 23.3962132958412887, c = 23.8695300240919046, d = 18.0270706502803826, gamma_0 = .849207617197620168, k = 47.2566613484212397, kappa = 0.627728277005953905e-1]

2 - P2) - for details see the maple files



parsolu1 = [a = 6.420733780, d = 10.52996420, k = 43.77419686, gamma0 = (7/9)*Pi, A0x = 46.70693512, A0y = -3.592841163]

For the optimization we have to synchronise the points of target K and the real points found for specific angles φ.



Herein I used the points = [21, 4, 5, 6, 8, 12, 16, 18, 19, 20] for optimisation. It leads to the results:

parsolu2 = [A0x = 46.8942264106864997, A0y = -3.89519642598157922, a = 4.99784151670588805, d = 8.33364233148796174, gamma0 = 2.45150231938922492, k = 43.7804571458663503].

Different points gives in various results.