

Appendix A. Input data

Tables

Table A.1: Gear pump A. (PD Matrix)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	M
1	0.0	55.0	85.5	121.0	85.5	55.0	70.5	Inf	Inf	Inf	Inf	164.4	258.6	209.9	213.3	202.6
2	55.0	0.0	56.0	85.5	97.6	86.0	59.8	Inf	Inf	Inf	Inf	195.5	285.5	238.3	241.5	191.9
3	85.5	56.0	0.0	55.0	86.0	97.6	59.8	Inf	Inf	Inf	Inf	231.5	321.5	274.3	277.5	189.3
4	121.0	85.5	55.0	0.0	55.0	85.5	70.5	Inf	Inf	Inf	Inf	249.4	343.6	294.9	298.3	196.8
5	85.5	97.6	86.0	55.0	0.0	56.0	59.8	Inf	Inf	Inf	Inf	231.5	321.5	274.3	277.5	189.3
6	55.0	86.0	97.6	85.5	56.0	0.0	59.8	Inf	Inf	Inf	Inf	195.5	285.5	238.3	241.5	191.9
7	70.5	59.8	59.8	70.5	59.8	59.8	0.0	72.5	62.0	62.0	51.0	209.9	311.5	260.4	273.8	187.3
8	Inf	Inf	Inf	Inf	Inf	Inf	72.5	0.0	64.5	100.5	53.5	145.3	244.6	195.9	199.3	215.6
9	Inf	Inf	Inf	Inf	Inf	Inf	62.0	64.5	0.0	78.0	11.0	171.7	271.0	222.3	225.7	212.8
10	Inf	Inf	Inf	Inf	Inf	Inf	62.0	100.5	78.0	0.0	67.0	207.7	307.0	258.3	261.7	210.4
11	Inf	Inf	Inf	Inf	Inf	Inf	51.0	53.5	11.0	67.0	0.0	178.9	278.1	229.4	232.8	201.8
12	164.4	195.5	231.5	249.4	231.5	195.5	209.9	145.3	171.7	207.7	178.9	0.0	144.2	84.9	96.1	171.9
13	258.6	285.5	321.5	343.6	321.5	285.5	311.5	244.6	271.0	307.0	278.1	144.2	0.0	61.0	56.0	423.1
14	209.9	238.3	274.3	294.9	274.3	238.3	260.4	195.9	222.3	258.3	229.4	84.9	61.0	0.0	Inf	362.1
15	213.3	241.5	277.5	298.3	277.5	241.5	273.8	199.3	225.7	261.7	232.8	96.1	56.0	Inf	0.0	316.5
M	202.6	191.9	189.3	196.8	189.3	191.9	187.3	215.6	212.8	210.4	201.8	171.9	423.1	362.1	316.5	0.0

Table A.2: Gear pump B (PD Matrix)

1	0.0	76.2	132.2	126.0	132.2	76.2	68.2	Inf	Inf	Inf	75.5	236.5	121.7	128.7	135.7	142.7	179.5	213.5	213.5	208.5	211.5	211.5	244.1
2	76.2	0.0	76.0	132.2	138.4	82.4	74.4	Inf	Inf	Inf	131.7	242.7	139.5	146.5	153.5	160.5	185.7	219.7	171.7	214.7	166.7	217.7	169.7
3	132.2	76.0	0.0	76.2	82.4	138.4	116.4	Inf	Inf	Inf	187.7	284.7	195.5	202.5	209.5	216.5	227.7	261.7	213.7	256.7	208.7	259.7	211.7
4	126.0	132.2	76.2	0.0	76.2	132.2	110.2	Inf	Inf	Inf	181.5	278.5	189.3	196.3	203.3	210.3	221.5	255.5	255.5	250.5	253.5	253.5	280.1
5	132.2	138.4	82.4	76.2	0.0	76.0	116.4	Inf	Inf	Inf	187.7	284.7	195.5	202.5	209.5	216.5	227.7	213.7	261.7	208.7	256.7	211.7	259.7
6	76.2	82.4	138.4	132.2	76.0	0.0	74.4	Inf	Inf	Inf	131.7	242.7	139.5	146.5	153.5	160.5	185.7	171.7	219.7	166.7	214.7	169.7	279.3
7	Inf	Inf	Inf	Inf	Inf	Inf	0.0	85.2	Inf	Inf	123.7	220.7	131.5	138.5	145.5	152.5	163.7	197.7	197.7	192.7	195.7	195.7	250.3
8	Inf	Inf	Inf	Inf	Inf	Inf	Inf	0.0	52.5	94.5	58.5	219.5	104.7	111.7	118.7	125.7	162.5	196.5	196.5	191.5	194.5	194.5	245.8
9	Inf	Inf	Inf	Inf	Inf	Inf	Inf	Inf	0.0	62.0	90.0	187.0	97.8	104.8	111.8	118.8	130.0	164.0	164.0	159.0	162	162	252.6
10	Inf	Inf	Inf	Inf	Inf	Inf	Inf	Inf	62.0	0.0	38.0	132.0	229.0	139.8	146.8	153.8	160.8	172.0	206.0	201.0	201.0	204	267.0
11	Inf	Inf	Inf	Inf	Inf	Inf	Inf	Inf	80.0	Inf	0.0	150.0	247.0	157.8	164.8	171.8	178.8	190.0	224.0	219.0	219.0	222	265.3
12	Inf	Inf	Inf	Inf	Inf	Inf	Inf	Inf	Inf	Inf	0.0	Inf	Inf	Inf	Inf	Inf	Inf	Inf	Inf	Inf	Inf	Inf	253.9
13	236.5	242.7	284.7	278.5	284.7	242.7	220.7	219.5	187.0	229.0	247.0	181.0	0.0	Inf	Inf	Inf	Inf	Inf	Inf	Inf	Inf	Inf	320.8
14	121.7	139.5	195.5	189.3	195.5	139.5	131.5	104.7	97.8	139.8	157.8	66.2	134.8	0.0	Inf	Inf	Inf	Inf	Inf	Inf	Inf	Inf	266.1
15	128.7	146.5	202.5	196.3	202.5	146.5	138.5	111.7	104.8	146.8	164.8	73.2	Inf	27.0	0.0	Inf	Inf	Inf	Inf	Inf	Inf	Inf	268.8
16	135.7	153.5	209.5	203.3	209.5	153.5	145.5	118.7	111.8	153.8	171.8	80.2	Inf	27.0	0.0	Inf	Inf	Inf	Inf	Inf	Inf	Inf	271.6
17	142.7	160.5	216.5	210.3	216.5	160.5	152.5	125.7	118.8	160.8	178.8	87.2	Inf	Inf	27.0	0.0	Inf	Inf	Inf	Inf	Inf	Inf	274.6
18	179.5	185.7	227.7	221.5	227.7	185.7	163.7	162.5	130.0	172.0	190.0	124.0	Inf	Inf	Inf	56.8	0.0	Inf	Inf	Inf	Inf	Inf	288.6
19	213.5	219.7	261.7	255.5	213.7	171.7	197.7	196.5	164.0	206.0	224.0	158.0	Inf	Inf	Inf	Inf	54.0	0.0	68.0	Inf	Inf	Inf	313.7
20	213.5	171.7	213.7	255.5	261.7	219.7	197.7	196.5	164.0	206.0	224.0	158.0	Inf	Inf	Inf	Inf	54.0	68.0	0.0	73.0	Inf	70	274.4
21	208.5	214.7	256.7	250.5	208.7	166.7	192.7	191.5	159.0	201.0	219.0	153.0	Inf	Inf	Inf	Inf	Inf	25.0	73.0	0.0	68.0	Inf	311.3
22	208.5	166.7	208.7	250.5	256.7	214.7	192.7	191.5	159.0	201.0	219.0	153.0	Inf	Inf	Inf	Inf	Inf	73.0	25.0	68.0	0.0	71	271.6
23	211.5	217.7	259.7	253.5	211.7	169.7	195.7	194.5	162.0	204.0	222.0	156.0	Inf	Inf	Inf	Inf	Inf	Inf	70.0	23.0	71.0	0	68
24	211.5	169.7	211.7	253.5	259.7	217.7	195.7	194.5	162.0	204.0	222.0	156.0	Inf	Inf	Inf	Inf	Inf	70.0	Inf	71.0	23.0	68	0
M	244.1	219.0	240.7	280.1	296.6	279.3	250.3	245.8	252.6	267.0	265.3	253.9	320.8	266.1	268.8	271.6	274.6	288.6	313.7	274.4	311.3	271.6	273.3
																							0

Appendix B. Results

Tables

Table B.1: Gear Pump A Multi-objective Aggregate Approach Disassembly Output

Strategy	Disassembly Sequence	Disassembly Direction	Disassembly Mode	Disassembly Tool	Max Fitness Value
REC	15-1-6-5-4-3-2-7-10-11-9-14-13-8-12	1-2-2-2-2-2-2-2-2-2-1-2-2-1	3-3-3-3-3-3-3-3-3-3-3-3-4-3	2-1-1-1-1-1-4-3-3-3-3-3-4	-11.63538278
	15-1-2-3-4-5-6-7-10-11-9-14-13-8-12	1-2-2-2-2-2-2-2-2-2-1-2-2-2	3-3-3-3-3-3-3-3-3-3-3-3-4-3	2-1-1-1-1-1-4-3-3-3-3-3-4	
REM	15-1-6-5-4-3-2-7-10-11-9-14-13-8-12	1-2-2-2-2-2-2-2-2-2-1-2-2-2	2-3-3-3-3-3-2-2-2-2-2-4-2	2-1-1-1-1-1-4-3-3-3-3-3-4	36.7884878
	15-1-2-3-4-5-6-7-10-11-9-14-13-8-12	1-2-2-2-2-2-2-2-2-2-1-2-2-1	2-3-3-3-3-3-2-2-2-2-2-4-2	2-1-1-1-1-1-4-3-3-3-3-3-4	
REU	15-1-6-5-4-3-2-7-10-11-9-14-13-8-12	1-2-2-2-2-2-2-2-2-2-1-2-2-1	1-3-3-3-3-3-1-1-1-1-1-4-1	2-1-1-1-1-1-4-3-3-3-3-3-4	65.37537268
	15-1-2-3-4-5-6-7-10-11-9-14-13-8-12	1-2-2-2-2-2-2-2-2-2-1-2-2-2	1-3-3-3-3-3-1-1-1-1-1-4-1	2-1-1-1-1-1-4-3-3-3-3-3-4	

Note:

Disassembly Direction: 1 = Y+ direction, 2 = Y- direction

Disassembly Mode: 1=reuse, 2=remanufacturing, 3=recycling, 4=disposal

Disassembly Tool: 1=Spanner-I, 2 = Spanner-II, 3 = Gripper-I, 4 = Gripper-II

Table B.3: Gear Pump A Output of Recycle Strategy (Iteration 500, population 50) using MOBA

Disassembly Sequence	Disassembly Direction	Disassembly Mode	Disassembly Tool	Goal 1	Goal 2	Goal 3
15-1-3-2-6-5-4-7-10-9-11-14-13-8-12	1-2-2-2-2-2-2-2-2-2-1-2-2-1	3-3-3-3-3-3-3-3-3-3-3-4-3	2-1-1-1-1-1-1-4-3-3-3-3-3-4	-11.345	-0.155	-0.372
4-6-1-2-3-5-15-7-10-11-9-14-13-8-12	2-2-2-2-2-1-2-2-2-2-1-1-2-1	3-3-3-3-3-3-3-3-3-3-3-4-3	1-1-1-1-1-1-2-4-3-3-3-3-3-4	-11.455	-0.153	-0.372
15-2-6-1-4-5-3-7-10-9-11-14-13-8-12	1-2-2-2-2-2-2-2-2-2-1-2-2-2	3-3-3-3-3-3-3-3-3-3-3-4-3	2-1-1-1-1-1-1-4-3-3-3-3-3-4	-11.465	-0.156	-0.372
2-3-4-1-6-5-15-7-11-9-10-14-13-8-12	2-2-2-2-2-1-2-2-2-2-1-1-2-2	3-3-3-3-3-3-3-3-3-3-3-4-3	1-1-1-1-1-1-2-4-3-3-3-3-3-4	-11.614	-0.155	-0.372
6-5-1-2-4-3-7-15-14-13-9-11-10-8-12	2-2-2-2-2-2-1-1-2-2-2-2-2-2	3-3-3-3-3-3-3-3-3-3-3-4-3	1-1-1-1-1-1-4-2-3-3-3-3-3-4	-11.853	-0.154	-0.372
5-6-4-3-1-2-7-15-14-13-9-11-10-8-12	2-2-2-2-2-2-1-1-2-2-2-2-2-2	3-3-3-3-3-3-3-3-3-3-3-4-3	1-1-1-1-1-1-4-2-3-3-3-3-3-4	-11.853	-0.154	-0.372
15-2-3-4-6-5-1-7-11-9-14-13-10-8-12	1-2-2-2-2-2-2-2-2-1-2-2-2-1	3-3-3-3-3-3-3-3-3-3-3-4-3	2-1-1-1-1-1-1-4-3-3-3-3-3-4	-11.881	-0.161	-0.372
15-1-3-2-4-5-6-7-11-9-14-13-10-8-12	1-2-2-2-2-2-2-2-2-1-2-2-2-2	3-3-3-3-3-3-3-3-3-3-3-4-3	2-1-1-1-1-1-1-4-3-3-3-3-3-4	-11.884	-0.160	-0.372
1-3-2-4-5-6-7-15-14-13-9-11-10-8-12	2-2-2-2-2-2-1-1-1-2-2-2-2-2	3-3-3-3-3-3-3-3-3-3-3-4-3	1-1-1-1-1-1-4-2-3-3-3-3-3-4	-11.890	-0.154	-0.372
5-6-1-2-4-3-7-15-14-13-10-9-11-8-12	2-2-2-2-2-2-1-1-2-2-2-2-2-2	3-3-3-3-3-3-3-3-3-3-3-4-3	1-1-1-1-1-1-4-2-3-3-3-3-3-4	-11.892	-0.154	-0.372
6-1-2-4-5-3-7-15-14-13-10-9-11-8-12	2-2-2-2-2-2-1-1-1-2-2-2-2-2	3-3-3-3-3-3-3-3-3-3-3-4-3	1-1-1-1-1-1-4-2-3-3-3-3-3-4	-11.896	-0.154	-0.372
1-2-3-4-6-5-7-15-14-13-10-11-9-8-12	2-2-2-2-2-2-1-1-2-2-2-2-2-2	3-3-3-3-3-3-3-3-3-3-3-4-3	1-1-1-1-1-1-4-2-3-3-3-3-3-4	-11.898	-0.154	-0.372
1-2-5-3-4-6-7-15-14-13-9-11-10-8-12	2-2-2-2-2-2-1-1-1-2-2-2-2-2	3-3-3-3-3-3-3-3-3-3-3-4-3	1-1-1-1-1-1-4-2-3-3-3-3-3-4	-11.922	-0.154	-0.372
15-6-1-4-3-2-5-7-11-9-14-13-10-8-12	1-2-2-2-2-2-2-2-2-1-2-2-2-2	3-3-3-3-3-3-3-3-3-3-3-4-3	2-1-1-1-1-1-1-4-3-3-3-3-3-4	-11.939	-0.161	-0.372
15-6-5-3-2-1-4-7-9-11-14-13-10-8-12	1-2-2-2-2-2-2-2-2-1-1-2-2-2	3-3-3-3-3-3-3-3-3-3-3-4-3	2-1-1-1-1-1-1-4-3-3-3-3-3-4	-11.946	-0.161	-0.372
15-6-5-4-2-3-1-7-10-14-13-11-9-8-12	1-2-2-2-2-2-2-2-1-2-2-2-2-2	3-3-3-3-3-3-3-3-3-3-3-4-3	2-1-1-1-1-1-1-4-3-3-3-3-3-4	-11.954	-0.161	-0.372
1-3-5-2-6-4-15-7-9-10-11-14-13-8-12	2-2-2-2-2-2-1-2-2-2-2-1-1-2-1	3-3-3-3-3-3-3-3-3-3-3-4-3	1-1-1-1-1-1-2-4-3-3-3-3-3-4	-11.987	-0.158	-0.372
15-2-6-1-5-4-3-7-10-14-13-11-9-8-12	1-2-2-2-2-2-2-2-2-1-1-2-2-2-2	3-3-3-3-3-3-3-3-3-3-3-4-3	2-1-1-1-1-1-1-4-3-3-3-3-3-4	-11.997	-0.161	-0.372
15-5-6-2-3-4-1-7-10-14-13-9-11-8-12	1-2-2-2-2-2-2-2-2-1-2-2-2-2-1	3-3-3-3-3-3-3-3-3-3-3-4-3	2-1-1-1-1-1-1-4-3-3-3-3-3-4	-12.028	-0.162	-0.372
6-1-2-3-4-5-15-7-9-11-14-13-10-8-12	2-2-2-2-2-1-2-2-2-1-2-2-2-1	3-3-3-3-3-3-3-3-3-3-3-4-3	1-1-1-1-1-1-2-4-3-3-3-3-3-4	-12.044	-0.159	-0.372
5-4-3-1-2-6-15-7-11-9-14-13-10-8-12	2-2-2-2-2-1-2-2-2-1-2-2-2-1	3-3-3-3-3-3-3-3-3-3-3-4-3	1-1-1-1-1-1-2-4-3-3-3-3-3-4	-12.045	-0.159	-0.372
3-2-1-6-5-4-15-7-10-14-13-11-9-8-12	2-2-2-2-2-1-2-2-1-1-2-2-2-2	3-3-3-3-3-3-3-3-3-3-3-4-3	1-1-1-1-1-1-2-4-3-3-3-3-3-4	-12.053	-0.159	-0.372
6-5-1-2-3-4-15-7-11-9-14-13-10-8-12	2-2-2-2-2-2-1-2-2-2-1-1-2-2-2	3-3-3-3-3-3-3-3-3-3-3-4-3	1-1-1-1-1-1-2-4-3-3-3-3-3-4	-12.071	-0.159	-0.372
15-3-2-1-6-4-5-7-11-10-14-13-9-8-12	1-2-2-2-2-2-2-2-2-1-2-2-2-1	3-3-3-3-3-3-3-3-3-3-3-4-3	2-1-1-1-1-1-1-4-3-3-3-3-3-4	-12.087	-0.163	-0.372
2-3-5-6-1-4-15-7-10-14-13-9-11-8-12	2-2-2-2-2-1-2-2-1-1-2-2-2-1	3-3-3-3-3-3-3-3-3-3-3-4-3	1-1-1-1-1-1-2-4-3-3-3-3-3-4	-12.126	-0.159	-0.372
6-2-5-3-4-1-7-15-14-13-10-9-11-8-12	2-2-2-2-2-2-2-2-1-1-2-2-2-2	3-3-3-3-3-3-3-3-3-3-3-4-3	1-1-1-1-1-1-4-2-3-3-3-3-3-4	-12.137	-0.156	-0.372
2-3-6-5-4-1-7-15-9-10-11-14-13-8-12	2-2-2-2-2-2-1-2-2-2-1-2-2-2	3-3-3-3-3-3-3-3-3-3-3-4-3	1-1-1-1-1-1-4-2-3-3-3-3-3-4	-12.175	-0.160	-0.372
6-1-2-4-5-3-15-7-11-10-14-13-9-8-12	2-2-2-2-2-1-2-2-2-1-1-2-2-1	3-3-3-3-3-3-3-3-3-3-3-4-3	1-1-1-1-1-1-2-4-3-3-3-3-3-4	-12.199	-0.160	-0.372
2-3-1-6-4-5-7-11-9-8-15-14-13-10-12	2-2-2-2-2-2-2-2-2-1-1-2-2-1	3-3-3-3-3-3-3-3-4-3-3-3-3	1-1-1-1-1-1-4-3-3-2-3-3-3-4	-12.202	-0.157	-0.372
4-3-6-1-2-5-15-7-10-11-14-13-9-8-12	2-2-2-2-2-1-2-2-2-1-2-2-2-1	3-3-3-3-3-3-3-3-3-3-3-4-3	1-1-1-1-1-1-2-4-3-3-3-3-3-4	-12.220	-0.160	-0.372
1-5-6-4-2-3-15-7-11-9-14-13-10-8-12	2-2-2-2-2-1-2-2-2-1-2-2-2-1	3-3-3-3-3-3-3-3-3-3-3-4-3	1-1-1-1-1-1-2-4-3-3-3-3-3-4	-12.244	-0.161	-0.372
6-5-4-2-1-3-7-9-10-8-15-14-13-11-12	2-2-2-2-2-2-2-2-2-1-1-1-2-1	3-3-3-3-3-3-3-3-4-3-3-3-3	1-1-1-1-1-1-4-3-3-2-3-3-3-4	-12.261	-0.158	-0.372
1-2-4-3-6-5-15-7-10-13-14-11-9-8-12	2-2-2-2-2-1-2-2-2-1-2-2-2-1	3-3-3-3-3-3-3-3-3-3-3-4-3	1-1-1-1-1-1-2-4-3-3-3-3-3-4	-12.265	-0.161	-0.372
2-3-5-1-6-4-7-9-11-8-15-14-13-10-12	2-2-2-2-2-2-2-2-2-1-1-2-2-2	3-3-3-3-3-3-3-3-4-3-3-3-3	1-1-1-1-1-1-4-3-3-2-3-3-3-4	-12.285	-0.158	-0.372
2-6-1-5-4-3-7-10-9-8-15-14-13-11-12	2-2-2-2-2-2-2-2-2-1-1-2-2-1	3-3-3-3-3-3-3-3-4-3-3-3-3	1-1-1-1-1-1-4-3-3-2-3-3-3-4	-12.336	-0.158	-0.372
2-1-6-5-4-15-3-7-10-11-9-14-13-8-12	2-2-2-2-2-1-2-2-2-2-1-2-2-2	3-3-3-3-3-3-3-3-3-3-3-4-3	1-1-1-1-1-2-1-4-3-3-3-3-3-4	-12.499	-0.160	-0.372
5-6-1-3-2-4-7-11-10-9-15-14-13-8-12	2-2-2-2-2-2-2-2-2-1-1-1-2-2	3-3-3-3-3-3-3-3-3-3-3-4-3	1-1-1-1-1-1-4-3-3-2-3-3-3-4	-12.522	-0.156	-0.372
5-2-1-3-6-4-7-11-9-10-15-14-13-8-12	2-2-2-2-2-2-2-2-2-1-1-2-2-2	3-3-3-3-3-3-3-3-3-3-3-4-3	1-1-1-1-1-1-4-3-3-2-3-3-3-4	-12.590	-0.157	-0.372
15-1-6-5-4-3-2-7-10-11-9-8-14-13-12	1-2-2-2-2-2-2-2-2-2-2-1-1-2	3-3-3-3-3-3-3-3-3-3-4-3-3-3	2-1-1-1-1-1-1-4-3-3-3-3-3-4	-12.602	-0.166	-0.372
6-4-3-5-2-1-7-9-11-10-15-14-13-8-12	2-2-2-2-2-2-2-2-2-1-1-1-2-1	3-3-3-3-3-3-3-3-3-3-3-4-3	1-1-1-1-1-1-4-3-3-2-3-3-3-4	-12.642	-0.157	-0.372
15-1-6-5-3-4-2-7-11-9-10-8-14-13-12	1-2-2-2-2-2-2-2-2-2-2-1-1-2	3-3-3-3-3-3-3-3-3-3-4-3-3-3	2-1-1-1-1-1-1-4-3-3-3-3-3-4	-12.664	-0.166	-0.372
2-1-6-5-4-3-15-7-10-11-9-8-14-13-12	2-2-2-2-2-1-2-2-2-2-2-1-1-2	3-3-3-3-3-3-3-3-3-3-4-3-3-3	1-1-1-1-1-1-2-4-3-3-3-3-3-4	-12.849	-0.165	-0.372
6-2-1-4-5-3-15-7-10-8-9-14-13-11-12	2-2-2-2-2-1-2-2-2-2-1-1-2-1	3-3-3-3-3-3-3-3-4-3-3-3-3	1-1-1-1-1-1-2-4-3-3-3-3-3-4	-12.935	-0.165	-0.372

Note:

Disassembly Direction: 1 = Y+ direction, 2 = Y- direction
 Disassembly Mode: 1=reuse, 2=remanufacturing, 3=recycling, 4=disposal
 Disassembly Tool: 1=Spanner-I, 2 = Spanner-II, 3 = Gripper-I, 4 = Gripper-II

Table B.4: Gear Pump A Output of Recycle Strategy (Iteration 500, population 50) using NSGA-II

Disassembly Sequence	Disassembly Direction	Disassembly Mode	Disassembly Tool	Goal 1	Goal 2	Goal 3
5-1-3-4-6-2-7-15-14-13-11-8-10-12-9	2-2-2-2-2-2-1-1-1-2-2-2-1-2	3-3-3-3-3-3-3-3-3-4-3-3-3	1-1-1-1-1-4-2-3-3-3-3-3-4-3	-14.383	-0.168	-0.372
2-1-3-5-4-15-6-7-10-13-8-11-9-14-12	2-2-2-2-1-2-2-2-2-2-2-1-2	3-3-3-3-3-3-3-3-3-4-3-3-3	1-1-1-1-1-2-1-4-3-3-3-3-3-4	-14.175	-0.174	-0.372
15-2-6-4-5-1-14-3-7-10-11-9-13-8-12	1-2-2-2-2-1-2-2-2-2-1-2-1	3-3-3-3-3-3-3-3-3-4-3	2-1-1-1-1-1-3-1-4-3-3-3-3-4	-14.664	-0.176	-0.372
2-4-3-6-5-1-15-7-10-8-13-11-9-12-14	2-2-2-2-2-1-2-2-2-2-2-2-2	3-3-3-3-3-3-3-3-4-3-3-3-3	1-1-1-1-1-1-2-4-3-3-3-3-3-4	-14.729	-0.166	-0.372
3-4-2-1-6-5-15-14-13-12-7-8-10-9-11	2-2-2-2-2-1-1-1-1-2-1-1-1-1	3-3-3-3-3-3-3-3-3-4-3-3-3	1-1-1-1-1-1-2-3-3-4-4-3-3-3-3	-13.095	-0.157	-0.372
15-14-13-2-3-1-4-5-6-12-8-9-11-10-7	1-1-1-2-2-2-2-1-1-1-1-1-1-2	3-3-3-3-3-3-3-3-3-4-3-3-3	2-3-3-1-1-1-1-1-1-4-3-3-3-3-4	-13.885	-0.164	-0.372
2-1-6-5-3-4-15-14-13-7-8-12-9-10-11	2-2-2-2-2-1-1-1-2-1-2-1-1	3-3-3-3-3-3-3-3-3-4-3-3-3	1-1-1-1-1-1-2-3-3-4-3-3-3-3	-14.412	-0.164	-0.372
4-3-5-2-6-1-15-7-10-9-14-11-13-8-12	2-2-2-2-2-1-2-2-2-1-2-1-2-2	3-3-3-3-3-3-3-3-3-4-3-3-3	1-1-1-1-1-1-2-4-3-3-3-3-3-4	-13.052	-0.167	-0.372
1-2-4-6-5-15-14-13-12-7-11-9-10-8	2-2-2-2-2-1-1-1-2-1-2-1-1-2	3-3-3-3-3-3-3-3-3-3-3-3-4	1-1-1-1-1-1-2-3-3-1-4-4-3-3-3-3	-14.469	-0.164	-0.372
15-1-5-4-3-2-6-14-13-12-7-8-9-11-10	1-2-2-2-2-2-1-1-1-2-2-1-1-1	3-3-3-3-3-3-3-3-3-4-3-3-3	2-1-1-1-1-1-1-3-3-4-4-3-3-3-3	-13.370	-0.165	-0.372
3-5-4-6-2-1-15-14-13-12-9-10-8-11-7	2-2-2-2-2-1-1-1-1-1-1-1-1-1	3-3-3-3-3-3-3-3-3-3-3-4-3-3	1-1-1-1-1-1-2-3-3-4-3-3-3-3-4	-14.397	-0.166	-0.372
3-4-2-15-14-13-1-6-5-7-12-8-11-9-10	2-2-2-1-1-1-2-2-2-1-2-2-2-1	3-3-3-3-3-3-3-3-3-4-3-3-3	1-1-1-2-3-3-1-1-1-4-4-3-3-3-3	-14.441	-0.167	-0.372
5-4-1-3-2-15-6-7-11-9-14-10-13-12-8	2-2-2-2-2-1-2-2-2-2-1-2-1-1	3-3-3-3-3-3-3-3-3-3-3-3-4	1-1-1-1-1-2-1-4-3-3-3-3-3-4-3	-15.890	-0.176	-0.372
1-6-5-3-2-4-15-7-8-11-13-14-10-12-9	2-2-2-2-2-1-2-2-2-1-2-1-2-2	3-3-3-3-3-3-3-4-3-3-3-3-3	1-1-1-1-1-1-2-4-3-3-3-3-3-4-3	-14.069	-0.168	-0.372
15-1-14-6-2-4-3-5-7-12-13-8-9-10-11	1-2-1-2-2-2-2-2-1-1-2-2-1-2	3-3-3-3-3-3-3-3-3-3-3-3-3	2-1-3-1-1-1-1-1-4-4-3-3-3-3-3	-14.973	-0.166	-0.372
6-2-1-3-4-5-15-14-12-7-9-8-13-10-11	2-2-2-2-2-1-1-1-2-1-1-2-1-2	3-3-3-3-3-3-3-3-3-3-3-4-3-3	1-1-1-1-1-1-2-3-3-4-4-3-3-3-3	-14.318	-0.167	-0.372
3-6-4-1-2-5-15-14-13-7-12-8-9-11-10	2-2-2-2-2-1-1-1-2-1-2-2-2-2	3-3-3-3-3-3-3-3-3-4-3-3-3	1-1-1-1-1-1-2-3-3-4-4-3-3-3-3	-13.725	-0.165	-0.372
2-1-5-6-3-15-14-4-7-9-11-10-13-12-8	2-2-2-2-2-1-1-2-2-2-2-1-1-1	3-3-3-3-3-3-3-3-3-3-3-3-4	1-1-1-1-1-2-3-1-4-3-3-3-3-4-3	-16.751	-0.176	-0.372
3-4-5-6-2-15-14-13-1-12-7-10-9-8-11	2-2-2-2-2-1-1-1-2-1-2-1-1-2-1	3-3-3-3-3-3-3-3-3-3-3-4-3	1-1-1-1-1-2-3-3-1-4-4-3-3-3-3	-14.334	-0.164	-0.372
6-15-14-2-5-4-3-1-7-10-8-11-9-13-12	2-1-1-2-2-2-2-2-2-2-2-2-1-2	3-3-3-3-3-3-3-3-3-4-3-3-3	1-2-3-1-1-1-1-1-4-3-3-3-3-3-4	-15.975	-0.183	-0.372
5-4-2-6-3-1-7-10-11-13-8-9-15-12-14	2-2-2-2-2-2-2-2-2-2-2-1-2-1	3-3-3-3-3-3-3-3-3-4-3-3-3	1-1-1-1-1-1-4-3-3-3-3-3-2-4-3	-14.316	-0.162	-0.372
6-4-1-3-2-5-7-10-9-15-13-14-8-11-12	2-2-2-2-2-2-2-2-1-2-1-2-2-1	3-3-3-3-3-3-3-3-3-3-3-4-3-3	1-1-1-1-1-1-4-3-3-2-3-3-3-3-4	-14.365	-0.169	-0.372
3-2-5-1-6-4-15-14-13-7-11-9-10-8-12	2-2-2-2-2-1-1-1-2-2-2-2-2-1	3-3-3-3-3-3-3-3-3-3-3-4-3	1-1-1-1-1-1-2-3-3-4-3-3-3-3-4	-13.041	-0.162	-0.372
5-4-6-3-1-2-7-15-14-9-12-13-8-10-11	2-2-2-2-2-2-1-1-2-1-1-2-2-2	3-3-3-3-3-3-3-3-3-3-3-4-3-3	1-1-1-1-1-1-4-2-3-3-4-3-3-3-3	-14.520	-0.160	-0.372
1-5-3-2-4-6-7-15-13-14-10-8-9-11-12	2-2-2-2-2-2-1-2-1-2-2-2-2-2	3-3-3-3-3-3-3-3-3-4-3-3-3	1-1-1-1-1-1-4-2-3-3-3-3-3-4	-13.628	-0.166	-0.372
1-5-2-6-4-15-3-7-8-11-14-9-10-13-12	2-2-2-2-1-2-2-2-2-1-2-2-1-1	3-3-3-3-3-3-3-4-3-3-3-3-3	1-1-1-1-1-2-1-4-3-3-3-3-3-3-4	-15.196	-0.182	-0.372
6-1-5-4-3-2-15-14-13-7-12-9-10-11-8	2-2-2-2-2-1-1-1-2-1-2-1-1-2	3-3-3-3-3-3-3-3-3-3-3-3-3-4	1-1-1-1-1-1-2-3-3-4-4-3-3-3-3	-14.044	-0.163	-0.372
2-3-6-5-1-4-7-10-13-11-8-15-9-14-12	2-2-2-2-2-2-2-2-2-2-1-2-1-1	3-3-3-3-3-3-3-3-3-4-3-3-3	1-1-1-1-1-1-4-3-3-3-3-2-3-3-4	-14.000	-0.178	-0.372
6-4-1-3-5-2-15-14-13-7-12-11-10-9-8	2-2-2-2-2-1-1-1-2-1-1-2-2-1	3-3-3-3-3-3-3-3-3-3-3-3-3-4	1-1-1-1-1-1-2-3-3-4-4-3-3-3-3	-14.384	-0.167	-0.372
1-6-2-4-5-15-3-7-9-8-10-14-11-13-12	2-2-2-2-2-1-2-2-2-2-1-2-1-2	3-3-3-3-3-3-3-3-4-3-3-3-3	1-1-1-1-1-2-1-4-3-3-3-3-3-3-4	-15.235	-0.183	-0.372
15-14-1-6-5-2-4-3-7-12-8-10-9-11-13	1-1-2-2-2-2-2-2-1-2-2-2-1-1	3-3-3-3-3-3-3-3-3-4-3-3-3	2-3-1-1-1-1-1-1-4-4-3-3-3-3-3	-13.376	-0.162	-0.372
15-14-13-3-4-6-1-5-2-7-12-10-11-8-9	1-1-1-2-2-2-2-2-2-1-1-1-2-1	3-3-3-3-3-3-3-3-3-3-3-3-4-3	2-3-3-1-1-1-1-1-1-4-4-3-3-3-3	-13.431	-0.165	-0.372
5-2-3-1-4-15-6-7-9-11-10-8-13-14-12	2-2-2-2-2-1-2-2-2-2-2-2-1-1	3-3-3-3-3-3-3-3-3-4-3-3-3	1-1-1-1-1-2-1-4-3-3-3-3-3-3-4	-14.075	-0.173	-0.372
5-4-6-2-1-3-7-9-15-13-8-10-11-12-14	2-2-2-2-2-2-2-2-1-2-2-2-2-2	3-3-3-3-3-3-3-3-3-4-3-3-3	1-1-1-1-1-1-4-3-2-3-3-3-3-4-3	-15.429	-0.161	-0.372
5-3-4-2-1-6-15-14-13-12-9-11-10-8-7	2-2-2-2-2-1-1-1-1-1-1-1-1-2	3-3-3-3-3-3-3-3-3-3-3-3-4-3	1-1-1-1-1-1-2-3-3-4-3-3-3-3-4	-13.040	-0.157	-0.372
5-1-6-4-2-3-7-10-11-8-9-13-15-14-12	2-2-2-2-2-2-2-2-2-2-2-1-1-2	3-3-3-3-3-3-3-3-4-3-3-3-3	1-1-1-1-1-1-4-3-3-3-3-3-2-3-4	-14.758	-0.175	-0.372
1-2-4-3-6-5-7-8-15-9-14-10-11-13-12	2-2-2-2-2-2-2-2-1-2-1-2-2-2-2	3-3-3-3-3-3-4-3-3-3-3-3-3	1-1-1-1-1-1-4-3-2-3-3-3-3-3-4	-14.141	-0.178	-0.372
3-5-2-6-4-15-1-7-11-10-9-8-12-14-13	2-2-2-2-2-1-2-2-2-2-2-2-1-1	3-3-3-3-3-3-3-3-3-4-3-3-3	1-1-1-1-1-2-1-4-3-3-3-3-3-3-3	-13.771	-0.159	-0.372

Note:

Disassembly Direction: 1 = Y+ direction, 2 = Y- direction

Disassembly Mode: 1=reuse, 2=remanufacturing, 3=recycling, 4=disposal

Disassembly Tool: 1=Spanner-I, 2 = Spanner-II, 3 = Gripper-I, 4 = Gripper-II

Table B.5: Gear Pump A Output of Recycle Strategy (Iteration 500, population 50) using PESA-II

Disassembly Sequence	Disassembly Direction	Disassembly Mode	Disassembly Tool	Goal 1	Goal 2	Goal 3
6-4-3-2-1-5-7-11-10-13-9-8-15-12-14	2-2-2-2-2-2-2-2-2-2-1-2-2	3-3-3-3-3-3-3-3-3-4-3-3-3	1-1-1-1-1-4-3-3-3-3-2-4-3	-13.171	-0.160	-0.372
2-5-1-3-6-4-7-11-13-8-15-10-9-14-12	2-2-2-2-2-2-2-2-1-2-2-1-1	3-3-3-3-3-3-3-3-4-3-3-3-3	1-1-1-1-1-4-3-3-2-3-3-3-4	-13.604	-0.174	-0.372
15-14-13-4-1-6-3-5-2-12-7-9-11-10-8	1-1-1-2-2-2-2-2-1-2-2-1-1-2	3-3-3-3-3-3-3-3-3-3-3-4	2-3-3-1-1-1-1-1-4-4-3-3-3-3	-13.627	-0.163	-0.372
5-3-2-6-1-4-7-15-8-10-13-11-9-14-12	2-2-2-2-2-2-1-2-2-2-2-1-1	3-3-3-3-3-3-3-4-3-3-3-3-3	1-1-1-1-1-4-2-3-3-3-3-3-4	-13.775	-0.173	-0.372
4-6-1-5-2-3-15-7-10-9-8-13-11-14-12	2-2-2-2-2-1-2-2-2-2-2-1-2	3-3-3-3-3-3-3-3-3-4-3-3-3	1-1-1-1-1-2-4-3-3-3-3-3-4	-13.778	-0.173	-0.372
15-3-4-2-6-1-5-7-11-13-9-8-14-10-12	1-2-2-2-2-2-2-2-2-2-1-2-1	3-3-3-3-3-3-3-3-3-4-3-3-3	2-1-1-1-1-1-4-3-3-3-3-3-3	-13.798	-0.177	-0.372
6-1-3-2-5-4-15-7-9-11-8-13-10-12-14	2-2-2-2-2-1-2-2-2-2-2-2-1	3-3-3-3-3-3-3-3-3-4-3-3-3	1-1-1-1-1-2-4-3-3-3-3-3-4	-13.978	-0.159	-0.372
4-2-1-3-5-6-7-8-11-10-9-15-12-13-14	2-2-2-2-2-2-2-2-2-1-2-2-2	3-3-3-3-3-3-4-3-3-3-3-3-3	1-1-1-1-1-4-3-3-3-2-4-3-3	-13.998	-0.157	-0.372
6-2-3-1-4-5-15-7-9-8-10-11-12-13-14	2-2-2-2-2-1-2-2-2-2-2-2-2	3-3-3-3-3-3-3-3-4-3-3-3-3	1-1-1-1-1-2-4-3-3-3-3-4-3-3	-14.156	-0.159	-0.372
5-4-1-2-6-3-7-10-15-13-14-8-9-11-12	2-2-2-2-2-2-2-1-2-1-2-2-2-1	3-3-3-3-3-3-3-3-3-4-3-3-3	1-1-1-1-1-4-3-2-3-3-3-3-4	-14.273	-0.168	-0.372
4-2-1-3-5-6-7-11-10-9-15-13-8-12-14	2-2-2-2-2-2-2-2-1-2-2-2-2	3-3-3-3-3-3-3-3-3-3-4-3-3	1-1-1-1-1-4-3-3-2-3-3-3-4-3	-14.300	-0.155	-0.372
5-4-6-2-3-1-7-8-15-11-10-9-13-12-14	2-2-2-2-2-2-2-1-2-2-2-2-1	3-3-3-3-3-3-4-3-3-3-3-3-3	1-1-1-1-1-4-3-2-3-3-3-3-4-3	-14.398	-0.166	-0.372
4-3-2-1-6-5-7-15-10-9-11-13-14-12-8	2-2-2-2-2-2-1-2-2-2-2-1-1-2	3-3-3-3-3-3-3-3-3-3-3-3-4	1-1-1-1-1-4-2-3-3-3-3-3-4-3	-14.466	-0.168	-0.372
3-2-5-4-6-1-15-7-11-14-8-9-10-12-13	2-2-2-2-2-1-2-2-1-2-2-2-1-1	3-3-3-3-3-3-3-3-3-4-3-3-3	1-1-1-1-1-2-4-3-3-3-3-3-4-3	-14.495	-0.164	-0.372
2-1-5-3-4-15-14-13-6-7-12-10-9-8-11	2-2-2-2-2-1-1-1-2-2-1-2-2-1-1	3-3-3-3-3-3-3-3-3-3-3-4-3	1-1-1-1-1-2-3-3-1-4-4-3-3-3-3	-14.575	-0.166	-0.372
6-4-5-1-2-3-15-7-14-8-12-13-9-10-11	2-2-2-2-2-1-2-1-2-1-2-1-2-1	3-3-3-3-3-3-3-3-4-3-3-3-3	1-1-1-1-1-2-4-3-3-4-3-3-3-3	-14.631	-0.164	-0.372
1-3-6-4-5-15-14-13-2-12-7-11-10-9-8	2-2-2-2-2-1-1-2-1-2-1-1-1-2	3-3-3-3-3-3-3-3-3-3-3-3-4	1-1-1-1-1-2-3-3-1-4-4-3-3-3-3	-14.655	-0.166	-0.372
15-2-6-4-5-1-14-3-7-10-11-9-13-8-12	1-2-2-2-2-1-2-2-2-2-2-1-2-1	3-3-3-3-3-3-3-3-3-3-3-4-3	2-1-1-1-1-3-1-4-3-3-3-3-3-4	-14.664	-0.176	-0.372
6-2-5-1-3-15-14-13-4-12-7-8-9-11-10	2-2-2-2-2-1-1-1-2-1-2-2-1-1-2	3-3-3-3-3-3-3-3-3-4-3-3-3	1-1-1-1-1-2-3-3-1-4-4-3-3-3-3	-14.693	-0.170	-0.372
6-2-3-4-1-5-15-7-8-9-10-13-14-12-11	2-2-2-2-2-1-2-2-2-2-2-1-1-2	3-3-3-3-3-3-3-4-3-3-3-3-3	1-1-1-1-1-2-4-3-3-3-3-3-4-3	-14.695	-0.172	-0.372
6-2-4-1-3-5-7-9-10-8-13-15-14-11-12	2-2-2-2-2-2-2-2-2-2-1-1-2-1	3-3-3-3-3-3-3-3-4-3-3-3-3	1-1-1-1-1-4-3-3-3-2-3-3-4	-14.705	-0.174	-0.372
5-3-1-4-6-15-14-13-2-7-12-11-8-9-10	2-2-2-2-2-1-1-1-2-2-1-1-2-2-1	3-3-3-3-3-3-3-3-3-3-3-4-3	1-1-1-1-1-2-3-3-1-4-4-3-3-3-3	-14.729	-0.170	-0.372
2-4-3-6-5-1-15-7-10-8-13-11-9-12-14	2-2-2-2-2-1-2-2-2-2-2-2-2-2	3-3-3-3-3-3-3-3-4-3-3-3-3	1-1-1-1-1-2-4-3-3-3-3-3-4-3	-14.729	-0.166	-0.372
1-2-6-5-4-3-7-8-9-10-13-11-15-14-12	2-2-2-2-2-2-2-2-2-2-2-1-1-2	3-3-3-3-3-3-4-3-3-3-3-3-3	1-1-1-1-1-4-3-3-3-3-3-2-3-4	-14.742	-0.175	-0.372
1-3-4-5-6-15-14-2-7-12-13-8-11-9-10	2-2-2-2-2-1-1-2-2-1-2-1-2-2-1	3-3-3-3-3-3-3-3-3-3-4-3-3	1-1-1-1-1-2-3-1-4-4-3-3-3-3	-14.831	-0.165	-0.372
1-3-4-6-5-2-7-10-8-9-15-13-11-14-12	2-2-2-2-2-2-2-2-2-1-2-2-1-1	3-3-3-3-3-3-3-4-3-3-3-3-3	1-1-1-1-1-4-3-3-3-2-3-3-3-4	-14.934	-0.175	-0.372
2-4-6-1-3-5-7-15-13-9-10-8-14-12-11	2-2-2-2-2-2-1-2-2-2-2-1-1-2	3-3-3-3-3-3-3-3-3-4-3-3-3	1-1-1-1-1-4-2-3-3-3-3-3-4-3	-15.059	-0.171	-0.372
4-3-5-1-6-2-15-7-13-14-12-9-11-10-8	2-2-2-2-2-1-2-2-1-1-1-2-2-2	3-3-3-3-3-3-3-3-3-3-3-3-4	1-1-1-1-1-2-4-3-3-4-3-3-3-3	-15.097	-0.168	-0.372
6-2-4-3-5-1-7-11-10-9-15-13-14-12-8	2-2-2-2-2-2-2-2-2-1-2-1-1-2	3-3-3-3-3-3-3-3-3-3-3-3-4	1-1-1-1-1-4-3-3-3-2-3-3-4-3	-15.446	-0.167	-0.372
1-3-6-5-2-15-4-7-9-10-11-13-14-12-8	2-2-2-2-2-1-2-2-2-2-2-1-1-1	3-3-3-3-3-3-3-3-3-3-3-3-4	1-1-1-1-1-2-1-4-3-3-3-3-3-4-3	-15.464	-0.173	-0.372

Note:

Disassembly Direction: 1 = Y+ direction, 2 = Y- direction

Disassembly Mode: 1=reuse, 2=remanufacturing, 3=recycling, 4=disposal

Disassembly Tool: 1=Spanner-I, 2 = Spanner-II, 3 = Gripper-I, 4 = Gripper-II

Table B.6: Gear Pump A Output of Remanufacturing Strategy (Iteration 500, population 50) using MOBA

Disassembly Sequence	Disassembly Direction	Disassembly Mode	Disassembly Tool	Goal 1	Goal 2	Goal 3
15-1-6-5-2-3-4-7-10-11-9-14-13-8	1-2-2-2-2-2-2-2-2-1-2-2-1	2-3-3-3-3-3-2-2-2-2-2-4-2	2-1-1-1-1-1-4-3-3-3-3-3-4	37.448	0.546	-1.340
15-6-1-2-3-4-5-7-9-11-10-14-13-8	1-2-2-2-2-2-2-2-2-1-1-2-2	2-3-3-3-3-3-2-2-2-2-2-4-2	2-1-1-1-1-1-4-3-3-3-3-3-4	37.435	0.546	-1.340
15-3-4-5-6-1-2-7-10-9-11-14-13-8	1-2-2-2-2-2-2-2-2-1-2-2-2	2-3-3-3-3-3-2-2-2-2-2-4-2	2-1-1-1-1-1-4-3-3-3-3-3-4	37.392	0.545	-1.340
15-5-6-4-3-2-1-7-10-11-9-14-13-8	1-2-2-2-2-2-2-2-2-1-2-2-2	2-3-3-3-3-3-2-2-2-2-2-4-2	2-1-1-1-1-1-4-3-3-3-3-3-4	37.326	0.544	-1.340
15-6-5-3-2-1-4-7-11-10-9-14-13-8	1-2-2-2-2-2-2-2-2-1-1-2-2	2-3-3-3-3-3-2-2-2-2-2-4-2	2-1-1-1-1-1-4-3-3-3-3-3-4	37.302	0.544	-1.340
1-2-3-4-5-6-15-7-10-11-9-14-13-8	2-2-2-2-2-1-2-2-2-1-1-2-1	3-3-3-3-3-2-2-2-2-2-2-4-2	1-1-1-1-1-2-4-3-3-3-3-3-4	37.298	0.547	-1.340
2-1-3-4-5-6-15-7-10-11-9-14-13-8	2-2-2-2-2-1-2-2-2-1-2-2-2	3-3-3-3-3-2-2-2-2-2-2-4-2	1-1-1-1-1-2-4-3-3-3-3-3-4	37.247	0.547	-1.340
15-1-5-6-2-4-3-7-9-11-10-14-13-8	1-2-2-2-2-2-2-2-2-1-1-2-2	2-3-3-3-3-3-2-2-2-2-2-4-2	2-1-1-1-1-1-4-3-3-3-3-3-4	37.230	0.544	-1.340
15-3-4-6-5-2-1-7-10-11-9-14-13-8	1-2-2-2-2-2-2-2-2-1-1-2-1	2-3-3-3-3-3-2-2-2-2-2-4-2	2-1-1-1-1-1-4-3-3-3-3-3-4	37.211	0.543	-1.340
2-3-4-5-1-5-15-7-10-9-11-14-13-8	2-2-2-2-2-1-2-2-2-1-2-2-1	3-3-3-3-3-2-2-2-2-2-2-4-2	1-1-1-1-1-2-4-3-3-3-3-3-4	37.201	0.547	-1.340
6-1-5-4-3-2-15-7-10-9-11-14-13-8	2-2-2-2-2-1-2-2-2-1-2-2-2	3-3-3-3-3-2-2-2-2-2-2-4-2	1-1-1-1-1-2-4-3-3-3-3-3-4	37.197	0.546	-1.340
2-1-5-4-3-6-15-7-10-9-11-14-13-8	2-2-2-2-2-1-2-2-2-1-2-2-1	3-3-3-3-3-2-2-2-2-2-2-4-2	1-1-1-1-1-2-4-3-3-3-3-3-4	37.197	0.546	-1.340
1-6-5-2-3-4-15-7-10-11-9-14-13-8	2-2-2-2-2-1-2-2-2-1-2-2-2	3-3-3-3-3-2-2-2-2-2-2-4-2	1-1-1-1-1-2-4-3-3-3-3-3-4	37.196	0.546	-1.340
4-5-6-1-2-3-15-7-11-10-9-14-13-8	2-2-2-2-2-1-2-2-2-1-2-2-2	3-3-3-3-3-2-2-2-2-2-2-4-2	1-1-1-1-1-2-4-3-3-3-3-3-4	37.191	0.546	-1.340
3-5-6-1-2-4-15-7-10-9-11-14-13-8	2-2-2-2-2-1-2-2-2-1-1-2-1	3-3-3-3-3-2-2-2-2-2-2-4-2	1-1-1-1-1-2-4-3-3-3-3-3-4	37.186	0.546	-1.340
4-5-3-2-1-6-15-7-10-9-11-14-13-8	2-2-2-2-2-1-2-2-2-1-1-2-1	3-3-3-3-3-2-2-2-2-2-2-4-2	1-1-1-1-1-2-4-3-3-3-3-3-4	37.179	0.546	-1.340
4-3-5-6-1-2-15-7-10-9-11-14-13-8	2-2-2-2-2-1-2-2-2-1-1-2-2	3-3-3-3-3-2-2-2-2-2-2-4-2	1-1-1-1-1-2-4-3-3-3-3-3-4	37.179	0.546	-1.340
3-4-5-1-6-2-15-7-11-9-10-14-13-8	2-2-2-2-2-1-2-2-2-1-1-2-1	3-3-3-3-3-2-2-2-2-2-2-4-2	1-1-1-1-1-2-4-3-3-3-3-3-4	37.178	0.546	-1.340
2-3-6-5-4-1-15-7-10-11-9-14-13-8	2-2-2-2-2-1-2-2-2-1-1-2-1	3-3-3-3-3-2-2-2-2-2-2-4-2	1-1-1-1-1-2-4-3-3-3-3-3-4	37.178	0.546	-1.340
1-1-2-3-6-4-5-7-9-10-11-14-13-8	1-2-2-2-2-2-2-2-2-1-1-2-2	2-3-3-3-3-3-2-2-2-2-2-4-2	2-1-1-1-1-1-4-3-3-3-3-3-4	37.177	0.543	-1.340
6-4-5-1-2-3-15-7-10-11-9-14-13-8	2-2-2-2-2-1-2-2-2-1-2-2-2	3-3-3-3-3-2-2-2-2-2-2-4-2	1-1-1-1-1-2-4-3-3-3-3-3-4	37.170	0.546	-1.340
6-2-1-5-4-3-15-7-10-11-9-14-13-8	2-2-2-2-2-1-2-2-2-1-1-2-1	3-3-3-3-3-2-2-2-2-2-2-4-2	1-1-1-1-1-2-4-3-3-3-3-3-4	37.168	0.546	-1.340
4-3-1-6-5-2-15-7-11-9-10-14-13-8	2-2-2-2-2-1-2-2-2-1-2-2-1	3-3-3-3-3-2-2-2-2-2-2-4-2	1-1-1-1-1-2-4-3-3-3-3-3-4	37.155	0.546	-1.340
6-1-4-3-2-5-15-7-10-11-9-14-13-8	2-2-2-2-2-1-2-2-2-1-2-2-2	3-3-3-3-3-2-2-2-2-2-2-4-2	1-1-1-1-1-2-4-3-3-3-3-3-4	37.153	0.546	-1.340
5-6-2-1-3-4-15-7-10-11-9-14-13-8	2-2-2-2-2-1-2-2-2-1-1-2-1	3-3-3-3-3-2-2-2-2-2-2-4-2	1-1-1-1-1-2-4-3-3-3-3-3-4	37.152	0.546	-1.340
6-5-1-2-3-4-15-7-11-9-10-14-13-8	2-2-2-2-2-1-2-2-2-1-2-2-2	3-3-3-3-3-2-2-2-2-2-2-4-2	1-1-1-1-1-2-4-3-3-3-3-3-4	37.152	0.546	-1.340
5-6-2-3-4-1-15-7-11-9-10-14-13-8	2-2-2-2-2-1-2-2-2-1-1-2-1	3-3-3-3-3-2-2-2-2-2-2-4-2	1-1-1-1-1-2-4-3-3-3-3-3-4	37.142	0.546	-1.340
1-6-2-4-3-5-15-7-10-11-9-14-13-8	2-2-2-2-2-1-2-2-2-1-2-2-2	3-3-3-3-3-2-2-2-2-2-2-4-2	1-1-1-1-1-2-4-3-3-3-3-3-4	37.139	0.546	-1.340
2-6-1-5-4-3-15-7-10-9-11-14-13-8	2-2-2-2-2-1-2-2-2-1-1-2-2	3-3-3-3-3-2-2-2-2-2-2-4-2	1-1-1-1-1-2-4-3-3-3-3-3-4	37.119	0.546	-1.340
6-1-5-2-3-4-15-7-10-11-9-14-13-8	2-2-2-2-2-1-2-2-2-1-2-2-2	3-3-3-3-3-2-2-2-2-2-2-4-2	1-1-1-1-1-2-4-3-3-3-3-3-4	37.113	0.546	-1.340
15-6-1-3-2-5-4-7-9-10-11-14-13-8	1-2-2-2-2-2-2-2-2-1-2-2-1	2-3-3-3-3-3-2-2-2-2-2-4-2	2-1-1-1-1-1-4-3-3-3-3-3-4	37.109	0.542	-1.340
3-2-6-5-1-4-15-7-10-9-11-14-13-8	2-2-2-2-2-1-2-2-2-1-2-2-1	3-3-3-3-3-2-2-2-2-2-2-4-2	1-1-1-1-1-2-4-3-3-3-3-3-4	37.100	0.546	-1.340
2-4-3-6-1-5-15-7-10-9-11-14-13-8	2-2-2-2-2-1-2-2-2-1-1-2-2	3-3-3-3-3-2-2-2-2-2-2-4-2	1-1-1-1-1-2-4-3-3-3-3-3-4	37.087	0.545	-1.340
3-5-1-2-4-6-15-7-10-11-9-14-13-8	2-2-2-2-2-1-2-2-2-1-1-2-2	3-3-3-3-3-2-2-2-2-2-2-4-2	1-1-1-1-1-2-4-3-3-3-3-3-4	37.085	0.545	-1.340
2-3-5-4-6-1-15-7-10-9-11-14-13-8	2-2-2-2-2-1-2-2-2-1-2-2-2	3-3-3-3-3-2-2-2-2-2-2-4-2	1-1-1-1-1-2-4-3-3-3-3-3-4	37.079	0.545	-1.340
3-4-1-6-5-2-15-7-11-9-10-14-13-8	2-2-2-2-2-1-2-2-2-1-2-2-2	3-3-3-3-3-2-2-2-2-2-2-4-2	1-1-1-1-1-2-4-3-3-3-3-3-4	37.078	0.545	-1.340
5-1-6-3-2-4-15-7-10-9-11-14-13-8	2-2-2-2-2-1-2-2-2-1-1-2-1	3-3-3-3-3-2-2-2-2-2-2-4-2	1-1-1-1-1-2-4-3-3-3-3-3-4	37.070	0.545	-1.340
1-2-3-5-6-4-15-7-11-10-9-14-13-8	2-2-2-2-2-1-2-2-2-1-2-2-1	3-3-3-3-3-2-2-2-2-2-2-4-2	1-1-1-1-1-2-4-3-3-3-3-3-4	37.066	0.545	-1.340
4-6-5-3-2-1-15-7-10-9-11-14-13-8	2-2-2-2-2-1-2-2-2-1-2-2-1	3-3-3-3-3-2-2-2-2-2-2-4-2	1-1-1-1-1-2-4-3-3-3-3-3-4	37.063	0.545	-1.340
5-6-3-4-2-1-15-7-10-9-11-14-13-8	2-2-2-2-2-1-2-2-2-1-1-2-1	3-3-3-3-3-2-2-2-2-2-2-4-2	1-1-1-1-1-2-4-3-3-3-3-3-4	37.054	0.545	-1.340
2-6-5-3-4-1-15-7-11-9-10-14-13-8	2-2-2-2-2-1-2-2-2-1-2-2-1	3-3-3-3-3-2-2-2-2-2-2-4-2	1-1-1-1-1-2-4-3-3-3-3-3-4	37.052	0.545	-1.340
4-6-5-2-1-3-15-7-11-9-10-14-13-8	2-2-2-2-2-1-2-2-2-1-1-2-1	3-3-3-3-3-2-2-2-2-2-2-4-2	1-1-1-1-1-2-4-3-3-3-3-3-4	37.045	0.545	-1.340
3-2-4-5-1-6-15-7-11-10-9-14-13-8	2-2-2-2-2-1-2-2-2-1-2-2-1	3-3-3-3-3-2-2-2-2-2-2-4-2	1-1-1-1-1-2-4-3-3-3-3-3-4	37.037	0.545	-1.340
1-5-4-3-2-6-15-7-10-9-11-13-14-8	2-2-2-2-2-1-2-2-2-2-1-2-1	3-3-3-3-3-2-2-2-2-2-2-4-2	1-1-1-1-1-2-4-3-3-3-3-3-4	37.030	0.545	-1.340
5-6-1-4-2-3-15-7-10-9-11-14-13-8	2-2-2-2-2-1-2-2-2-1-1-2-1	3-3-3-3-3-2-2-2-2-2-2-4-2	1-1-1-1-1-2-4-3-3-3-3-3-4	37.027	0.545	-1.340
5-2-3-1-6-4-15-7-9-11-10-14-13-8	2-2-2-2-2-1-2-2-2-1-1-2-1	3-3-3-3-3-2-2-2-2-2-2-4-2	1-1-1-1-1-2-4-3-3-3-3-3-4	37.014	0.545	-1.340
2-4-3-6-1-5-15-7-10-11-9-13-14-8	2-2-2-2-2-1-2-2-2-2-1-2-2	3-3-3-3-3-2-2-2-2-2-2-4-2	1-1-1-1-1-2-4-3-3-3-3-3-4	37.003	0.545	-1.340
3-5-6-2-4-1-15-7-10-9-11-14-13-8	2-2-2-2-2-1-2-2-2-1-1-2-1	3-3-3-3-3-2-2-2-2-2-2-4-2	1-1-1-1-1-2-4-3-3-3-3-3-4	37.001	0.545	-1.340

Note:

Disassembly Direction: 1 = Y+ direction, 2 = Y- direction

Disassembly Mode: 1=reuse, 2=remanufacturing, 3=recycling, 4=disposal

Disassembly Tool: 1=Spanner-I, 2 = Spanner-II, 3 = Gripper-I, 4 = Gripper-II

Table B.7: Gear Pump A Output of Remanufacturing Strategy (Iteration 500, population 50) using NSGA-II

Disassembly Sequence	Disassembly Direction	Disassembly Mode	Disassembly Tool	Goal 1	Goal 2	Goal 3
2-6-1-3-5-4-15-7-11-9-10-14-13-8-12	2-2-2-2-2-1-2-2-2-1-1-2-2	3-3-3-3-3-2-2-2-2-2-4-2-1	1-1-1-1-1-2-4-3-3-3-3-3-4	36.987	0.544	-1.340
5-1-3-4-6-2-15-7-9-10-11-13-14-8-12	2-2-2-2-2-1-2-2-2-2-1-2-2	3-3-3-3-3-2-2-2-2-2-4-2-1	1-1-1-1-1-2-4-3-3-3-3-3-4	36.742	0.542	-1.340
15-3-4-5-2-1-6-7-11-9-14-13-8-10-12	1-2-2-2-2-2-2-2-1-2-2-2-1	2-3-3-3-3-2-2-2-2-4-2-2-2	2-1-1-1-1-1-4-3-3-3-3-3-4	36.112	0.535	-1.340
15-1-3-4-6-5-2-7-10-9-13-11-14-8-12	1-2-2-2-2-2-2-2-2-2-1-2-1	2-3-3-3-3-2-2-2-2-2-4-2-2	2-1-1-1-1-1-4-3-3-3-3-3-4	36.052	0.533	-1.340
3-4-5-2-1-6-15-7-10-11-8-14-13-9-12	2-2-2-2-2-1-2-2-2-1-2-2-2	3-3-3-3-3-2-2-2-2-4-2-2-2-1	1-1-1-1-1-2-4-3-3-3-3-3-4	36.028	0.537	-1.340
15-1-2-3-4-5-6-7-10-11-9-8-14-13-12	1-2-2-2-2-2-2-2-2-2-1-2-2	2-3-3-3-3-2-2-2-2-4-2-2-2	2-1-1-1-1-1-4-3-3-3-3-3-4	36.024	0.534	-1.340
15-1-3-6-4-2-5-7-10-13-9-11-14-8-12	1-2-2-2-2-2-2-2-2-2-1-2-2	2-3-3-3-3-2-2-2-2-2-4-2-2	2-1-1-1-1-1-4-3-3-3-3-3-4	35.966	0.532	-1.340
2-5-6-4-3-15-1-7-11-9-10-14-13-8-12	2-2-2-2-2-1-2-2-2-2-1-2-2	3-3-3-3-3-2-2-2-2-2-4-2-1	1-1-1-1-2-1-4-3-3-3-3-3-4	35.864	0.537	-1.340
15-14-13-2-1-6-5-3-4-7-12-8-10-9-11	1-1-1-2-2-2-2-2-1-2-2-2-2	2-2-2-3-3-3-3-2-2-4-2-2-2	2-3-3-1-1-1-1-1-4-4-3-3-3-3	35.853	0.543	-1.340
3-4-5-6-2-1-15-7-9-8-11-14-13-10-12	2-2-2-2-2-1-2-2-2-1-2-2-1	3-3-3-3-3-2-2-2-4-2-2-2-2-1	1-1-1-1-1-2-4-3-3-3-3-3-4	35.807	0.536	-1.340
15-14-13-1-3-6-2-4-5-7-12-8-9-11-10	1-1-1-2-2-2-2-2-2-1-1-1-1-1	2-2-2-3-3-3-3-2-2-4-2-2-2	2-3-3-1-1-1-1-1-4-4-3-3-3-3	35.794	0.540	-1.340
15-14-13-5-4-3-1-2-6-7-11-9-10-8-12	1-1-1-2-2-2-2-2-2-2-2-2-2	2-2-2-3-3-3-3-2-2-2-4-2-2	2-3-3-1-1-1-1-1-4-4-3-3-3-4	35.770	0.536	-1.340
15-14-13-5-1-2-3-4-6-7-12-8-10-11-9	1-1-1-2-2-2-2-2-2-1-2-2-2-1	2-2-2-3-3-3-3-2-2-4-2-2-2	2-3-3-1-1-1-1-1-4-4-3-3-3-3	35.769	0.540	-1.340
3-2-6-4-5-1-15-7-11-13-10-9-14-8-12	2-2-2-2-2-1-2-2-2-2-1-2-1	3-3-3-3-3-2-2-2-2-2-4-2-1	1-1-1-1-1-2-4-3-3-3-3-3-4	35.749	0.533	-1.340
15-4-6-1-2-3-5-7-8-9-11-10-13-14-12	1-2-2-2-2-2-2-2-2-2-1-2	2-3-3-3-3-2-4-2-2-2-2-2-2	2-1-1-1-1-1-4-3-3-3-3-3-4	35.734	0.532	-1.340
2-6-1-5-3-4-15-7-10-14-13-8-12-9-11	2-2-2-2-2-1-2-2-1-1-2-1-1-2	3-3-3-3-3-2-2-2-2-4-2-2-2-1	1-1-1-1-1-2-4-3-3-3-3-4-3-3	35.720	0.542	-1.340
4-2-1-5-3-6-15-7-8-11-9-13-14-10-12	2-2-2-2-2-1-2-2-2-2-1-2-1	3-3-3-3-3-2-2-4-2-2-2-2-2-1	1-1-1-1-1-2-4-3-3-3-3-3-4	35.670	0.535	-1.340
2-1-5-3-6-4-15-7-9-14-13-8-11-10-12	2-2-2-2-2-1-2-2-1-2-2-2-2	3-3-3-3-3-2-2-2-2-4-2-2-2-1	1-1-1-1-1-2-4-3-3-3-3-3-4	35.637	0.534	-1.340
6-2-1-5-4-3-7-8-15-11-9-13-14-10-12	2-2-2-2-2-2-2-1-2-2-2-1-2	3-3-3-3-3-2-4-2-2-2-2-2-2-1	1-1-1-1-1-4-3-2-3-3-3-3-3-4	35.596	0.531	-1.340
3-2-1-6-4-5-15-14-13-12-7-8-10-9-11	2-2-2-2-2-1-1-1-2-2-1-1-1	3-3-3-3-3-2-2-2-2-4-2-2-2-1	1-1-1-1-1-2-3-3-4-4-3-3-3-3	35.594	0.543	-1.340
5-1-3-2-4-6-15-14-13-12-7-11-9-10-8	2-2-2-2-2-1-1-1-1-2-1-1-1-1	3-3-3-3-3-2-2-2-2-2-2-4-1	1-1-1-1-1-2-3-3-4-4-3-3-3-3	35.593	0.544	-1.340
2-6-4-3-1-5-7-10-11-9-13-8-15-14-12	2-2-2-2-2-2-2-2-2-2-1-1-1	3-3-3-3-3-2-2-2-2-4-2-2-2-1	1-1-1-1-1-4-3-3-3-3-2-3-4	35.592	0.534	-1.340
15-14-13-6-4-3-2-5-1-7-11-10-9-8-12	1-1-1-2-2-2-2-2-2-2-2-2-2	2-2-2-3-3-3-3-2-2-2-4-2-2	2-3-3-1-1-1-1-1-4-4-3-3-3-4	35.559	0.534	-1.340
2-1-3-5-4-6-7-11-10-9-13-8-15-14-12	2-2-2-2-2-2-2-2-2-2-1-1-1	3-3-3-3-3-2-2-2-2-4-2-2-2-1	1-1-1-1-1-4-3-3-3-3-2-3-4	35.538	0.533	-1.340
1-2-4-5-6-3-15-14-13-12-7-8-11-10-9	2-2-2-2-2-1-1-1-1-2-1-1-1-1	3-3-3-3-3-2-2-2-2-4-2-2-2-1	1-1-1-1-1-2-3-3-4-4-3-3-3-3	35.533	0.540	-1.340
15-14-13-6-1-5-4-3-2-7-12-10-8-9-11	1-1-1-2-2-2-2-2-2-1-2-1-2-1	2-2-2-3-3-3-3-2-2-4-2-2-2	2-3-3-1-1-1-1-1-4-4-3-3-3-3	35.524	0.541	-1.340
1-5-4-3-2-6-7-15-13-11-9-14-10-8-12	2-2-2-2-2-2-1-2-2-2-1-2-2	3-3-3-3-3-2-2-2-2-2-4-2-1	1-1-1-1-1-4-2-3-3-3-3-3-4	35.523	0.536	-1.340
15-2-3-5-1-6-4-7-14-13-8-12-10-9-11	1-2-2-2-2-2-2-1-1-2-1-1-2-2	2-3-3-3-3-2-2-2-4-2-2-2-2	2-1-1-1-1-1-4-3-3-3-4-3-3-3	35.516	0.540	-1.340
15-14-13-6-3-1-5-2-4-7-10-11-9-8-12	1-1-1-2-2-2-2-2-2-2-2-2-2	2-2-2-3-3-3-3-2-2-2-4-2-2	2-3-3-1-1-1-1-1-4-4-3-3-3-4	35.507	0.534	-1.340
1-2-5-6-4-3-7-11-9-8-15-10-12-14-13	2-2-2-2-2-2-2-2-2-1-2-2-1-2	3-3-3-3-3-2-2-2-4-2-2-2-2-1	1-1-1-1-1-4-3-3-3-2-3-4-3-3	35.496	0.543	-1.340
5-1-6-4-3-2-7-9-8-15-13-14-10-11-12	2-2-2-2-2-2-2-2-1-2-1-2-2-1	3-3-3-3-3-2-2-4-2-2-2-2-2-1	1-1-1-1-1-4-3-3-2-3-3-3-3-4	35.481	0.536	-1.340
1-2-6-4-5-3-15-14-13-12-7-10-11-8-9	2-2-2-2-2-1-1-1-1-2-1-1-1-2	3-3-3-3-3-2-2-2-2-2-4-2-1	1-1-1-1-1-2-3-3-4-4-3-3-3-3	35.478	0.539	-1.340
3-4-6-1-15-2-5-7-9-11-10-14-13-8-12	2-2-2-2-1-2-2-2-2-2-1-2-2-2	3-3-3-3-2-3-2-2-2-2-2-4-2-1	1-1-1-1-2-1-1-4-3-3-3-3-3-4	35.477	0.533	-1.340
4-6-3-1-5-2-15-7-13-14-11-10-9-8-12	2-2-2-2-2-1-2-2-1-2-2-2-2	3-3-3-3-3-2-2-2-2-2-4-2-1	1-1-1-1-1-2-4-3-3-3-3-3-4	35.473	0.536	-1.340
3-2-6-1-4-5-15-14-13-12-7-10-9-11-8	2-2-2-2-2-2-1-1-1-1-2-1-1-2-2	3-3-3-3-3-2-2-2-2-2-2-4-1	1-1-1-1-1-2-3-3-4-4-3-3-3-3	35.465	0.543	-1.340
15-14-13-1-5-6-4-2-3-7-12-10-11-9-8	1-1-1-2-2-2-2-2-2-1-1-1-2-2	2-2-2-3-3-3-3-2-2-2-4-2-2	2-3-3-1-1-1-1-1-4-4-3-3-3-3	35.465	0.541	-1.340
15-14-13-2-3-5-6-1-4-7-12-11-8-9-10	1-1-1-2-2-2-2-2-2-1-2-2-2-1	2-2-2-3-3-3-3-2-2-4-2-2-2	2-3-3-1-1-1-1-1-4-4-3-3-3-3	35.459	0.537	-1.340
15-14-13-5-6-1-3-4-2-7-12-10-9-11-8	1-1-1-2-2-2-2-2-2-1-1-1-1-2	2-2-2-3-3-3-3-2-2-2-4-2-2	2-3-3-1-1-1-1-1-4-4-3-3-3-3	35.459	0.541	-1.340

Note:

Disassembly Direction: 1 = Y+ direction, 2 = Y- direction

Disassembly Mode: 1=reuse, 2=remanufacturing, 3=recycling, 4=disposal

Disassembly Tool: 1=Spanner-I, 2 = Spanner-II, 3 = Gripper-I, 4 = Gripper-II

Table B.8: Gear Pump A Output of Remanufacturing Strategy (Iteration 500, population 50) using PESA-II

Disassembly Sequence	Disassembly Direction	Disassembly Mode	Disassembly Tool	Goal 1	Goal 2	Goal 3
3-2-1-5-4-6-15-7-9-10-11-14-13-8-12	2-2-2-2-2-1-2-2-2-1-2-2-2	3-3-3-3-3-2-2-2-2-2-4-2	1-1-1-1-1-2-4-3-3-3-3-3-4	37.04	0.5451	-1.34
6-3-1-4-5-2-15-7-11-9-10-14-13-8-12	2-2-2-2-2-1-2-2-2-1-2-2-2	3-3-3-3-3-2-2-2-2-2-4-2	1-1-1-1-1-2-4-3-3-3-3-3-4	36.872	0.5432	-1.34
5-2-6-3-4-1-7-11-9-10-8-15-12-14-13	2-2-2-2-2-2-2-2-2-1-2-1-2	3-3-3-3-3-2-2-2-2-4-2-2-2	1-1-1-1-1-4-3-3-3-2-4-3-3	36.553	0.5483	-1.34
3-1-4-5-6-2-7-15-13-14-9-11-10-8-12	2-2-2-2-2-2-1-2-1-2-2-2-2	3-3-3-3-3-2-2-2-2-2-4-2	1-1-1-1-1-4-2-3-3-3-3-3-4	36.501	0.5454	-1.34
15-4-6-1-2-5-3-7-10-14-13-11-9-8-12	1-2-2-2-2-2-2-2-1-1-2-2-2	2-3-3-3-3-2-2-2-2-2-4-2	2-1-1-1-1-1-4-3-3-3-3-3-4	36.493	0.5367	-1.34
15-4-3-5-2-1-6-7-9-11-14-13-10-8-12	1-2-2-2-2-2-2-2-1-1-2-2-2	2-3-3-3-3-2-2-2-2-2-4-2	2-1-1-1-1-1-4-3-3-3-3-3-4	36.478	0.5366	-1.34
5-1-6-4-2-3-15-7-11-14-13-9-10-8-12	2-2-2-2-2-1-2-2-1-1-2-2-2	3-3-3-3-3-2-2-2-2-2-4-2	1-1-1-1-1-2-4-3-3-3-3-3-4	36.382	0.5385	-1.34
1-3-5-4-6-2-15-7-9-11-14-13-10-8-12	2-2-2-2-2-1-2-2-1-1-2-2-2	3-3-3-3-3-2-2-2-2-2-4-2	1-1-1-1-1-2-4-3-3-3-3-3-4	36.362	0.5386	-1.34
6-1-2-3-4-5-15-7-11-9-10-8-12-13-14	2-2-2-2-2-1-2-2-2-2-2-2-2	3-3-3-3-3-2-2-2-2-4-2-2-2	1-1-1-1-1-2-4-3-3-3-4-3-3	36.237	0.5525	-1.34
4-3-2-6-5-1-15-7-11-10-9-8-12-14-13	2-2-2-2-2-1-2-2-2-2-2-1-2	3-3-3-3-3-2-2-2-2-4-2-2-2	1-1-1-1-1-2-4-3-3-3-4-3-3	36.21	0.5488	-1.34
6-5-3-1-4-2-15-7-11-14-13-10-9-8-12	2-2-2-2-2-1-2-2-1-1-2-2-2	3-3-3-3-3-2-2-2-2-2-4-2	1-1-1-1-1-2-4-3-3-3-3-3-4	36.167	0.5365	-1.34
15-6-4-5-1-2-3-7-10-9-11-8-12-13-14	1-2-2-2-2-2-2-2-2-2-2-1-1	2-3-3-3-3-2-2-2-2-4-2-2-2	2-1-1-1-1-1-4-3-3-3-4-3-3	36.159	0.5494	-1.34
15-6-1-2-3-4-5-7-8-9-11-13-14-10-12	1-2-2-2-2-2-2-2-2-2-1-2-1	2-3-3-3-3-2-4-2-2-2-2-2-2	2-1-1-1-1-1-4-3-3-3-3-3-4	36.097	0.5356	-1.34
4-5-3-1-6-2-7-11-9-10-8-15-14-13-12	2-2-2-2-2-2-2-2-2-1-1-1-1	3-3-3-3-3-2-2-2-4-2-2-2-2	1-1-1-1-1-4-3-3-3-2-3-3-4	36.079	0.5382	-1.34
1-6-5-2-3-4-7-9-11-8-15-13-14-10-12	2-2-2-2-2-2-2-2-2-1-2-1-2-1	3-3-3-3-3-2-2-4-2-2-2-2-2	1-1-1-1-1-4-3-3-2-3-3-3-4	36.052	0.5411	-1.34
15-1-4-5-6-2-3-7-9-14-11-10-13-8-12	1-2-2-2-2-2-2-2-1-2-2-2-2-1	2-3-3-3-3-2-2-2-2-2-4-2	2-1-1-1-1-1-4-3-3-3-3-3-4	36.038	0.5326	-1.34
4-6-5-1-2-3-15-7-11-10-14-9-13-8-12	2-2-2-2-2-1-2-2-2-1-2-2-2	3-3-3-3-3-2-2-2-2-2-4-2	1-1-1-1-1-2-4-3-3-3-3-3-4	35.95	0.5345	-1.34
1-6-5-4-3-2-15-7-11-9-10-13-8-14-12	2-2-2-2-2-1-2-2-2-2-2-1-1	3-3-3-3-3-2-2-2-2-4-2-2-2	1-1-1-1-1-2-4-3-3-3-3-3-4	35.855	0.5349	-1.34
1-2-3-4-5-6-7-15-8-9-10-14-13-11-12	2-2-2-2-2-2-1-2-2-2-1-2-2-1	3-3-3-3-3-2-4-2-2-2-2-2-2	1-1-1-1-1-4-2-3-3-3-3-3-4	35.827	0.5362	-1.34
5-3-4-6-1-2-15-7-9-14-13-8-12-11-10	2-2-2-2-2-1-2-2-1-1-2-1-2-1	3-3-3-3-3-2-2-2-2-4-2-2-2	1-1-1-1-1-2-4-3-3-3-4-3-3	35.775	0.5396	-1.34
2-1-6-3-4-5-7-15-13-14-8-12-10-11-9	2-2-2-2-2-2-1-2-1-2-1-2-2-1	3-3-3-3-3-2-2-2-4-2-2-2-2	1-1-1-1-1-4-2-3-3-3-4-3-3	35.743	0.545	-1.34
15-2-1-6-5-4-3-7-8-11-10-9-14-13-12	1-2-2-2-2-2-2-2-2-2-2-1-2	2-3-3-3-3-2-4-2-2-2-2-2-2	2-1-1-1-1-1-4-3-3-3-3-3-4	35.735	0.5315	-1.34
3-2-6-5-1-4-15-7-8-9-11-13-14-10-12	2-2-2-2-2-1-2-2-2-2-2-1-2-1	3-3-3-3-3-2-4-2-2-2-2-2-2	1-1-1-1-1-2-4-3-3-3-3-3-4	35.705	0.5351	-1.34
3-1-4-5-6-2-15-7-10-9-11-8-13-14-12	2-2-2-2-2-1-2-2-2-2-2-1-2	3-3-3-3-3-2-2-2-2-4-2-2-2	1-1-1-1-1-2-4-3-3-3-3-3-4	35.678	0.5341	-1.34
2-5-3-1-4-6-15-7-10-9-14-11-13-8-12	2-2-2-2-2-1-2-2-2-1-2-2-2	3-3-3-3-3-2-2-2-2-2-4-2	1-1-1-1-1-2-4-3-3-3-3-3-4	35.635	0.5317	-1.34
6-5-1-2-3-4-7-11-10-9-13-8-15-14-12	2-2-2-2-2-2-2-2-2-2-1-1-1	3-3-3-3-3-2-2-2-2-4-2-2-2	1-1-1-1-1-4-3-3-3-3-2-3-4	35.604	0.5337	-1.34
3-1-6-5-4-2-7-15-8-9-10-11-13-14-12	2-2-2-2-2-2-1-2-2-2-2-2-1-2	3-3-3-3-3-2-4-2-2-2-2-2-2	1-1-1-1-1-4-2-3-3-3-3-3-4	35.592	0.5334	-1.34
5-6-3-2-1-4-7-8-15-10-9-14-13-11-12	2-2-2-2-2-2-2-2-1-2-2-1-1-2	3-3-3-3-3-2-4-2-2-2-2-2-2	1-1-1-1-1-4-3-2-3-3-3-3-4	35.579	0.5311	-1.34
4-3-2-1-5-6-7-10-9-13-11-8-15-12-14	2-2-2-2-2-2-2-2-2-2-1-2-2	3-3-3-3-3-2-2-2-2-4-2-2-2	1-1-1-1-1-4-3-3-3-3-2-4-3	35.496	0.5404	-1.34
3-1-6-4-2-5-15-14-13-12-7-8-9-11-10	2-2-2-2-2-1-1-1-1-2-1-1-2-2	3-3-3-3-3-2-2-2-2-4-2-2-2	1-1-1-1-1-2-3-3-4-4-3-3-3	35.492	0.5401	-1.34
6-5-2-4-3-1-7-15-14-13-9-8-12-11-10	2-2-2-2-2-2-1-1-1-2-2-1-2-2	3-3-3-3-3-2-2-2-2-4-2-2-2	1-1-1-1-1-4-2-3-3-3-4-3-3	35.448	0.5391	-1.34
5-3-6-1-4-2-15-7-11-10-13-8-9-14-12	2-2-2-2-2-1-2-2-2-2-2-1-1	3-3-3-3-3-2-2-2-2-4-2-2-2	1-1-1-1-1-2-4-3-3-3-3-3-4	35.328	0.5305	-1.34
3-5-1-6-2-4-7-15-14-13-8-9-12-10-11	2-2-2-2-2-2-1-1-2-2-2-1-2-2	3-3-3-3-3-2-2-2-4-2-2-2-2	1-1-1-1-1-4-2-3-3-3-4-3-3	34.774	0.5393	-1.34
15-6-4-3-1-5-2-7-11-10-9-8-13-12-14	1-2-2-2-2-2-2-2-2-2-2-2-2	2-3-3-3-3-2-2-2-2-4-2-2-2	2-1-1-1-1-1-4-3-3-3-3-3-4	34.665	0.5373	-1.34

Note:

Disassembly Direction: 1 = Y+ direction, 2 = Y- direction

Disassembly Mode: 1=reuse, 2=remanufacturing, 3=recycling, 4=disposal

Disassembly Tool: 1=Spanner-I, 2 = Spanner-II, 3 = Gripper-I, 4 = Gripper-II

Table B.9: Gear Pump A Output of Reuse Strategy (Iteration 500, population 50) using NSGA-II

Disassembly Sequence	Disassembly Direction	Disassembly Mode	Disassembly Tool	Goal 1	Goal 2	Goal 3
15-6-5-2-3-4-1-7-10-8-11-14-13-9-12	1-2-2-2-2-2-2-2-2-1-1-2-1	1-3-3-3-3-3-1-1-4-1-1-1-1-1	2-1-1-1-1-1-4-3-3-3-3-3-4	63.105	0.754	-0.007
15-6-5-3-2-1-4-7-9-10-14-11-13-8-12	1-2-2-2-2-2-2-2-2-1-2-1-2-1	1-3-3-3-3-3-1-1-1-1-1-1-4-1	2-1-1-1-1-1-4-3-3-3-3-3-4	63.001	0.752	-0.007
4-3-2-5-6-1-15-7-10-8-11-14-13-9-12	2-2-2-2-2-1-2-2-2-1-1-2-1	3-3-3-3-3-3-1-1-4-1-1-1-1-1	1-1-1-1-1-1-2-4-3-3-3-3-3-4	62.885	0.755	-0.007
15-2-4-1-5-3-6-7-11-10-14-13-8-9-12	1-2-2-2-2-2-2-2-2-1-2-2-2-1	1-3-3-3-3-3-1-1-1-1-1-4-1-1	2-1-1-1-1-1-4-3-3-3-3-3-4	62.760	0.750	-0.007
15-14-13-2-3-1-4-5-6-12-7-10-11-9-8	1-1-1-2-2-2-2-2-1-2-2-2-2-2	1-1-1-3-3-3-3-3-1-1-1-1-1-4	2-3-3-1-1-1-1-1-4-4-3-3-3-3	62.527	0.759	-0.007
2-3-4-6-5-1-15-7-14-13-8-9-11-10-12	2-2-2-2-2-1-2-1-1-2-2-2-2-2	3-3-3-3-3-3-1-1-1-4-1-1-1-1	1-1-1-1-1-1-2-4-3-3-3-3-3-4	62.513	0.755	-0.007
15-3-2-5-4-6-1-7-9-8-14-13-10-11-12	1-2-2-2-2-2-2-2-2-1-2-2-2-1	1-3-3-3-3-3-1-1-4-1-1-1-1-1	2-1-1-1-1-1-4-3-3-3-3-3-4	62.397	0.747	-0.007
2-4-3-1-5-15-6-7-9-11-14-13-10-8-12	2-2-2-2-2-1-2-2-2-2-1-2-2-2-2	3-3-3-3-3-1-3-1-1-1-1-1-4-1	1-1-1-1-1-2-4-3-3-3-3-3-4	62.383	0.751	-0.007
3-6-4-1-2-5-15-14-13-12-7-9-11-10-8	2-2-2-2-2-1-1-1-1-2-1-1-2-1	3-3-3-3-3-3-1-1-1-1-1-1-4	1-1-1-1-1-1-2-3-3-4-4-3-3-3-3	62.344	0.761	-0.007
15-6-4-2-3-1-5-7-9-11-14-13-10-12-8	1-2-2-2-2-2-2-2-2-1-2-2-1-2	1-3-3-3-3-3-1-1-1-1-1-1-4	2-1-1-1-1-1-4-3-3-3-3-3-4-3	62.303	0.758	-0.007
1-4-2-6-3-15-5-7-9-11-14-13-10-8-12	2-2-2-2-2-1-2-2-2-2-1-2-2-2-1	3-3-3-3-3-1-3-1-1-1-1-1-4-1	1-1-1-1-1-2-4-3-3-3-3-3-4	62.184	0.749	-0.007
2-5-3-6-4-1-15-14-13-12-7-9-10-11-8	2-2-2-2-2-1-1-1-1-2-1-1-1-2	3-3-3-3-3-3-1-1-1-1-1-1-4	1-1-1-1-1-1-2-3-3-4-4-3-3-3-3	62.161	0.759	-0.007
15-6-3-4-1-2-5-14-12-7-11-10-9-13-8	1-2-2-2-2-2-1-1-2-2-2-2-1-2	1-3-3-3-3-3-1-1-1-1-1-1-4	2-1-1-1-1-1-3-4-4-3-3-3-3-3	62.103	0.756	-0.007
4-5-6-1-3-2-15-7-11-10-14-13-9-12-8	2-2-2-2-2-1-2-2-2-1-2-2-1-2	3-3-3-3-3-3-1-1-1-1-1-1-4	1-1-1-1-1-1-2-4-3-3-3-3-3-4-3	62.064	0.759	-0.007
15-3-6-4-5-1-2-14-13-12-7-10-11-9-8	1-2-2-2-2-2-1-1-1-2-2-2-2-2	1-3-3-3-3-3-1-1-1-1-1-1-4	2-1-1-1-1-1-3-3-4-4-3-3-3-3	62.039	0.754	-0.007
15-1-5-3-2-4-6-14-13-12-7-9-11-10-8	1-2-2-2-2-2-1-1-1-2-1-2-1-2	1-3-3-3-3-3-1-1-1-1-1-1-4	2-1-1-1-1-1-3-3-4-4-3-3-3-3	62.004	0.756	-0.007
15-5-4-1-6-2-3-14-13-12-7-11-9-10-8	1-2-2-2-2-2-1-1-1-2-2-2-2-1	1-3-3-3-3-3-1-1-1-1-1-1-4	2-1-1-1-1-1-3-3-4-4-3-3-3-3	61.923	0.753	-0.007
15-5-6-2-4-3-1-14-13-12-7-9-10-11-8	1-2-2-2-2-2-1-1-1-2-2-1-1-2	1-3-3-3-3-3-1-1-1-1-1-1-4	2-1-1-1-1-1-3-3-4-4-3-3-3-3	61.878	0.754	-0.007
2-4-1-3-5-6-7-15-8-10-14-13-9-11-12	2-2-2-2-2-2-2-1-2-2-1-1-2-2-2	3-3-3-3-3-3-1-1-4-1-1-1-1-1	1-1-1-1-1-1-4-2-3-3-3-3-3-4	61.830	0.745	-0.007
15-14-6-1-2-3-4-5-12-7-9-11-13-10-8	1-1-2-2-2-2-2-1-1-2-2-2-1-1	1-1-3-3-3-3-3-1-1-1-1-1-1-4	2-3-1-1-1-1-1-4-4-3-3-3-3-3	61.515	0.750	-0.007
4-1-2-3-6-5-7-15-14-13-10-9-11-12-8	2-2-2-2-2-2-1-1-2-2-2-2-1-2	3-3-3-3-3-3-1-1-1-1-1-1-4	1-1-1-1-1-1-4-2-3-3-3-3-3-4-3	61.474	0.757	-0.007
2-1-6-5-4-15-14-13-12-7-11-9-10-8	2-2-2-2-1-1-1-2-1-2-1-1-1-2	3-3-3-3-3-1-1-1-3-1-1-1-1-4	1-1-1-1-1-2-3-3-1-4-4-3-3-3-3	61.431	0.757	-0.007
15-14-1-6-5-3-4-2-12-7-11-13-9-10-8	1-1-2-2-2-2-2-1-2-2-1-2-2-1	1-1-3-3-3-3-3-1-1-1-1-1-1-4	2-3-1-1-1-1-1-4-4-3-3-3-3-3	61.413	0.750	-0.007
6-3-4-5-1-15-14-13-12-7-11-9-10-8	2-2-2-2-1-1-1-2-1-2-2-2-1-2	3-3-3-3-3-1-1-1-3-1-1-1-1-4	1-1-1-1-1-2-3-3-1-4-4-3-3-3-3	61.320	0.756	-0.007
5-1-3-2-4-15-14-13-6-7-12-10-11-9-8	2-2-2-2-1-1-1-2-1-2-2-2-1-1	3-3-3-3-3-1-1-1-3-1-1-1-1-4	1-1-1-1-1-2-3-3-1-4-4-3-3-3-3	61.305	0.756	-0.007
1-2-5-3-6-15-14-13-4-7-12-9-11-10-8	2-2-2-2-2-1-1-1-2-2-1-2-2-2-1	3-3-3-3-3-1-1-1-3-1-1-1-1-4	1-1-1-1-1-2-3-3-1-4-4-3-3-3-3	61.285	0.756	-0.007
6-5-2-1-3-15-14-13-4-7-12-11-10-9-8	2-2-2-2-1-1-1-2-2-1-1-1-1-2	3-3-3-3-3-1-1-1-3-1-1-1-1-4	1-1-1-1-1-2-3-3-1-4-4-3-3-3-3	61.231	0.755	-0.007
3-5-4-6-1-2-15-14-13-12-9-10-11-7-8	2-2-2-2-2-1-1-1-1-1-1-2-1	3-3-3-3-3-3-1-1-1-1-1-1-4	1-1-1-1-1-1-2-3-3-4-3-3-3-4-3	60.246	0.750	-0.007

Note:

Disassembly Direction: 1 = Y+ direction, 2 = Y- direction

Disassembly Mode: 1=reuse, 2=remanufacturing, 3=recycling, 4=disposal

Disassembly Tool: 1=Spanner-I, 2 = Spanner-II, 3 = Gripper-I, 4 = Gripper-II

Table B.10: Gear Pump A Output of Reuse Strategy (Iteration 500, population 50) using PESA-II

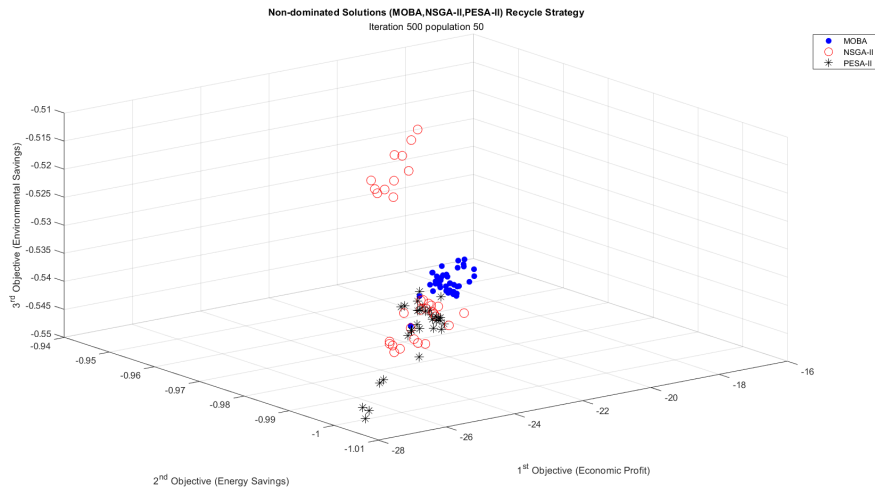
Disassembly Sequence	Disassembly Direction	Disassembly Mode	Disassembly Tool	Goal 1	Goal 2	Goal 3
1-4-5-6-2-3-15-7-9-11-10-14-13-8-12	2-2-2-2-2-1-2-2-2-1-2-2-2	3-3-3-3-3-1-1-1-1-1-1-4-1	1-1-1-1-1-2-4-3-3-3-3-3-4	63.967	0.763	-0.007
4-5-6-2-1-3-7-15-14-13-9-11-10-8-12	2-2-2-2-2-2-1-1-2-2-2-2-2	3-3-3-3-3-1-1-1-1-1-1-4-1	1-1-1-1-1-4-2-3-3-3-3-3-4	63.942	0.766	-0.007
3-2-4-5-1-6-7-15-14-13-9-11-10-8-12	2-2-2-2-2-2-1-1-2-2-2-2-2	3-3-3-3-3-1-1-1-1-1-1-4-1	1-1-1-1-1-4-2-3-3-3-3-3-4	63.873	0.765	-0.007
3-5-1-2-4-6-7-11-9-10-15-14-13-8-12	2-2-2-2-2-2-2-2-2-1-1-1-2-2	3-3-3-3-3-1-1-1-1-1-1-4-1	1-1-1-1-1-4-3-3-2-3-3-3-4	63.215	0.762	-0.007
3-6-5-4-2-1-7-9-11-10-15-14-13-8-12	2-2-2-2-2-2-2-2-2-1-1-2-2-1	3-3-3-3-3-1-1-1-1-1-1-4-1	1-1-1-1-1-4-3-3-2-3-3-3-4	63.174	0.762	-0.007
2-3-1-5-6-15-4-7-11-9-14-13-10-8-12	2-2-2-2-1-2-2-2-2-1-1-2-2-2	3-3-3-3-3-1-3-1-1-1-1-1-4-1	1-1-1-1-1-2-1-4-3-3-3-3-3-4	62.426	0.751	-0.007
15-4-3-6-5-2-1-7-10-8-14-13-11-9-12	1-2-2-2-2-2-2-2-2-1-2-2-2-1	1-3-3-3-3-3-1-1-4-1-1-1-1-1	2-1-1-1-1-1-4-3-3-3-3-3-4	62.361	0.746	-0.007
4-2-1-3-6-15-5-7-10-11-14-13-9-8-12	2-2-2-2-2-1-2-2-2-1-1-2-2-1	3-3-3-3-3-1-3-1-1-1-1-1-4-1	1-1-1-1-1-2-1-4-3-3-3-3-3-4	62.328	0.750	-0.007
2-6-4-3-1-5-7-15-8-14-13-11-10-9-12	2-2-2-2-2-2-1-2-1-1-2-2-2-2	3-3-3-3-3-1-1-4-1-1-1-1-1-1	1-1-1-1-1-4-2-3-3-3-3-3-4	62.318	0.749	-0.007
3-5-6-1-2-4-7-15-8-11-14-13-9-10-12	2-2-2-2-2-2-1-2-2-1-2-2-2-1	3-3-3-3-3-1-1-4-1-1-1-1-1-1	1-1-1-1-1-4-2-3-3-3-3-3-4	62.275	0.749	-0.007
15-2-6-5-3-4-1-14-12-7-10-9-11-13-8	1-2-2-2-2-2-1-1-2-2-1-1-2-2	1-3-3-3-3-3-1-1-1-1-1-1-1-4	2-1-1-1-1-1-3-4-4-3-3-3-3-3	62.272	0.757	-0.007
2-6-4-5-1-3-15-7-11-10-14-8-13-9-12	2-2-2-2-2-1-2-2-2-1-2-1-2-2	3-3-3-3-3-1-1-1-1-1-4-1-1-1	1-1-1-1-1-2-4-3-3-3-3-3-4	62.172	0.749	-0.007
5-15-6-4-1-2-3-7-11-14-13-9-10-8-12	2-1-2-2-2-2-2-2-2-1-2-2-2-2	3-1-3-3-3-3-1-1-1-1-1-1-4-1	1-2-1-1-1-1-4-3-3-3-3-3-4	62.131	0.748	-0.007
6-2-1-4-5-3-15-7-10-14-13-9-8-11-12	2-2-2-2-2-1-2-2-1-1-2-2-2-2	3-3-3-3-3-1-1-1-1-1-4-1-1	1-1-1-1-1-2-4-3-3-3-3-3-4	62.125	0.748	-0.007
15-3-4-6-2-1-5-14-13-7-10-11-9-8-12	1-2-2-2-2-2-1-1-2-2-2-2-2-1	1-3-3-3-3-3-1-1-1-1-1-1-4-1	2-1-1-1-1-1-3-3-4-3-3-3-3-4	62.084	0.748	-0.007
15-1-4-2-6-3-5-14-12-7-9-11-10-13-8	1-2-2-2-2-2-1-1-2-1-2-2-2-2	1-3-3-3-3-3-1-1-1-1-1-1-1-4	2-1-1-1-1-1-3-4-4-3-3-3-3-3	62.072	0.755	-0.007
4-2-6-1-3-15-5-7-11-9-8-14-13-10-12	2-2-2-2-1-2-2-2-2-1-2-2-2	3-3-3-3-3-1-3-1-1-4-1-1-1-1	1-1-1-1-1-2-1-4-3-3-3-3-3-4	61.991	0.749	-0.007
4-2-1-5-6-3-7-15-14-13-11-12-9-10-8	2-2-2-2-2-2-1-1-1-2-1-2-1-2	3-3-3-3-3-1-1-1-1-1-1-1-4	1-1-1-1-1-4-2-3-3-3-4-3-3-3	61.853	0.761	-0.007
4-2-5-6-1-3-15-14-13-7-12-10-11-9-8	2-2-2-2-2-1-1-1-2-1-2-2-1-1	3-3-3-3-3-1-1-1-1-1-1-1-4	1-1-1-1-1-2-3-3-4-4-3-3-3-3	61.714	0.755	-0.007
15-5-3-2-1-6-4-7-10-13-14-11-12-9-8	1-2-2-2-2-2-2-2-2-1-2-1-2-1	1-3-3-3-3-3-1-1-1-1-1-1-4	2-1-1-1-1-1-4-3-3-3-3-4-3-3	61.673	0.752	-0.007
1-2-5-4-6-15-3-7-8-10-9-14-13-11-12	2-2-2-2-1-2-2-2-2-1-2-2-2	3-3-3-3-3-1-3-1-4-1-1-1-1-1	1-1-1-1-1-2-1-4-3-3-3-3-3-4	61.626	0.746	-0.007
5-6-4-3-1-15-14-13-2-7-12-10-11-9-8	2-2-2-2-1-1-1-2-2-1-1-1-1-2	3-3-3-3-3-1-1-3-1-1-1-1-1-4	1-1-1-1-1-2-3-3-1-4-4-3-3-3-3	61.372	0.757	-0.007
1-4-5-6-3-15-14-13-2-7-12-11-10-9-8	2-2-2-2-1-1-1-2-2-1-2-1-2-1	3-3-3-3-3-1-1-3-1-1-1-1-1-4	1-1-1-1-1-2-3-3-1-4-4-3-3-3-3	61.061	0.755	-0.007

Note:

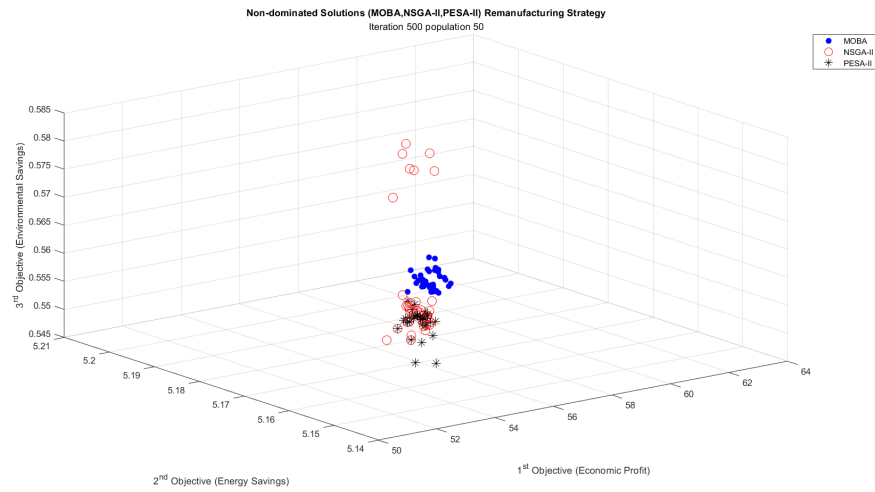
Disassembly Direction: 1 = Y+ direction, 2 = Y- direction

Disassembly Mode: 1=reuse, 2=remanufacturing, 3=recycling, 4=disposal

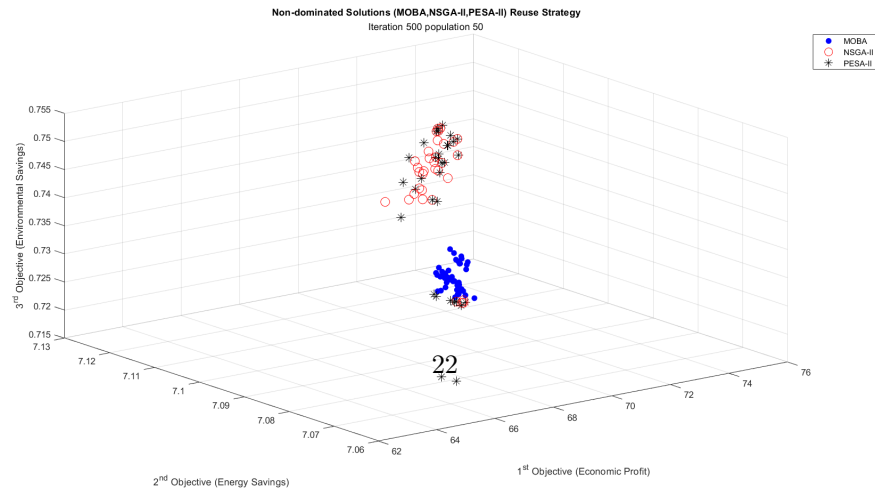
Disassembly Tool: 1=Spanner-I, 2 = Spanner-II, 3 = Gripper-I, 4 = Gripper-II



(a) Gear pump B - POSs RECYCLE Strategy



(b) Gear pump B - POSs REMANUFACTURING Strategy



(c) Gear pump B - POSs REUSE Strategy

Figure B.1: POSs for Gear Pump B using MOBA, NSGA-II and PESA-II (Iteration 500, population size 50)