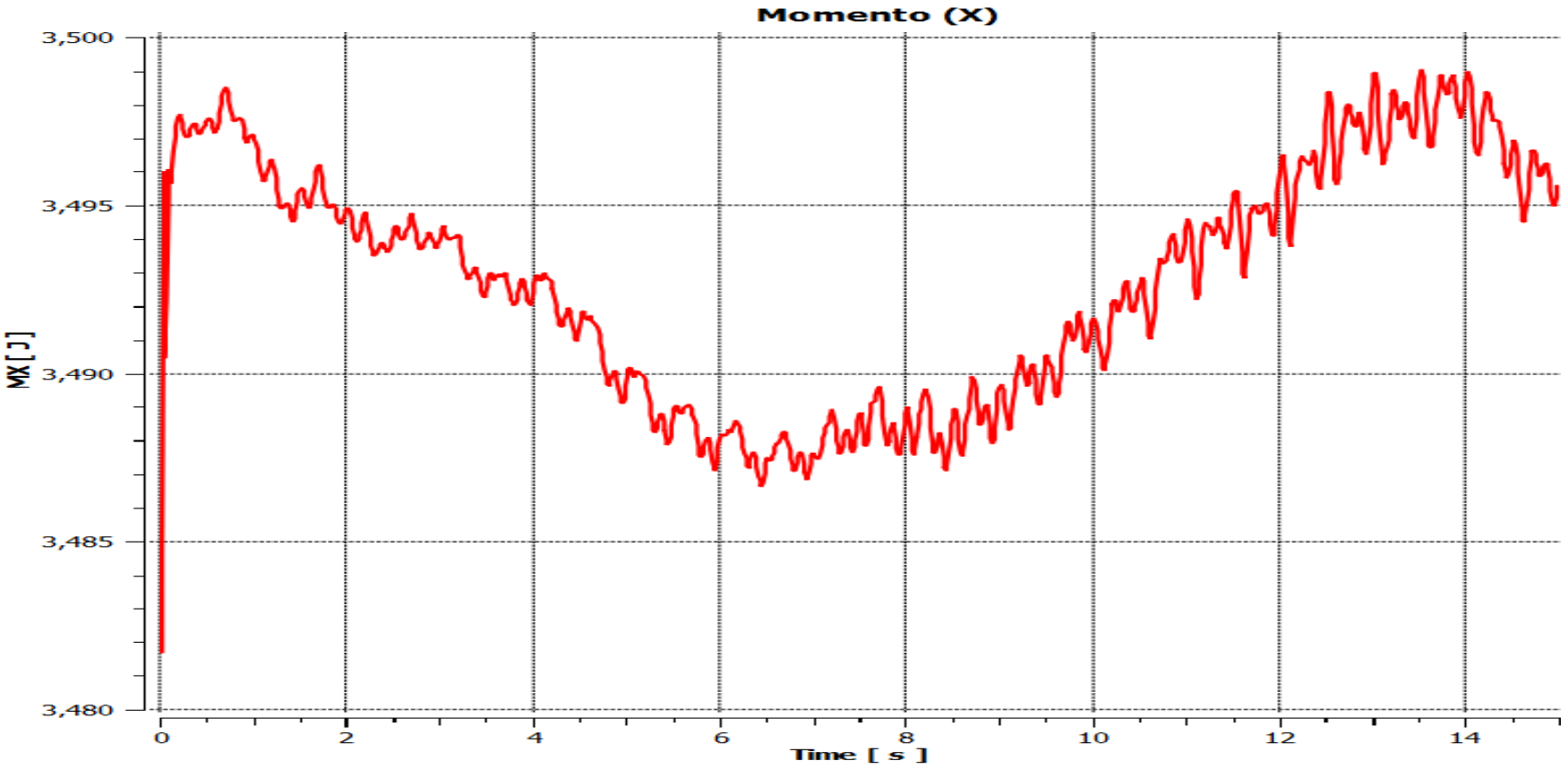
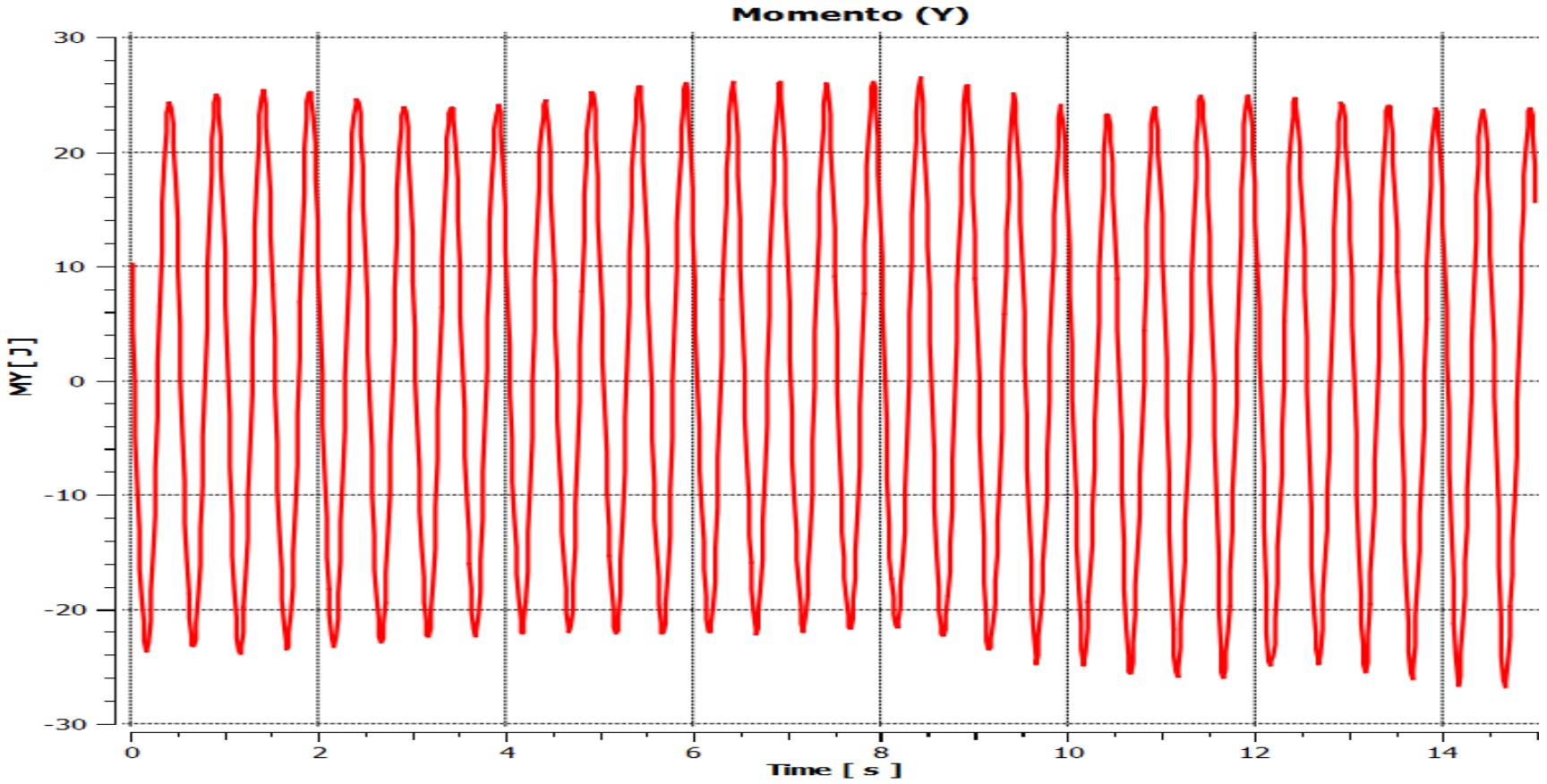
ANEXOS

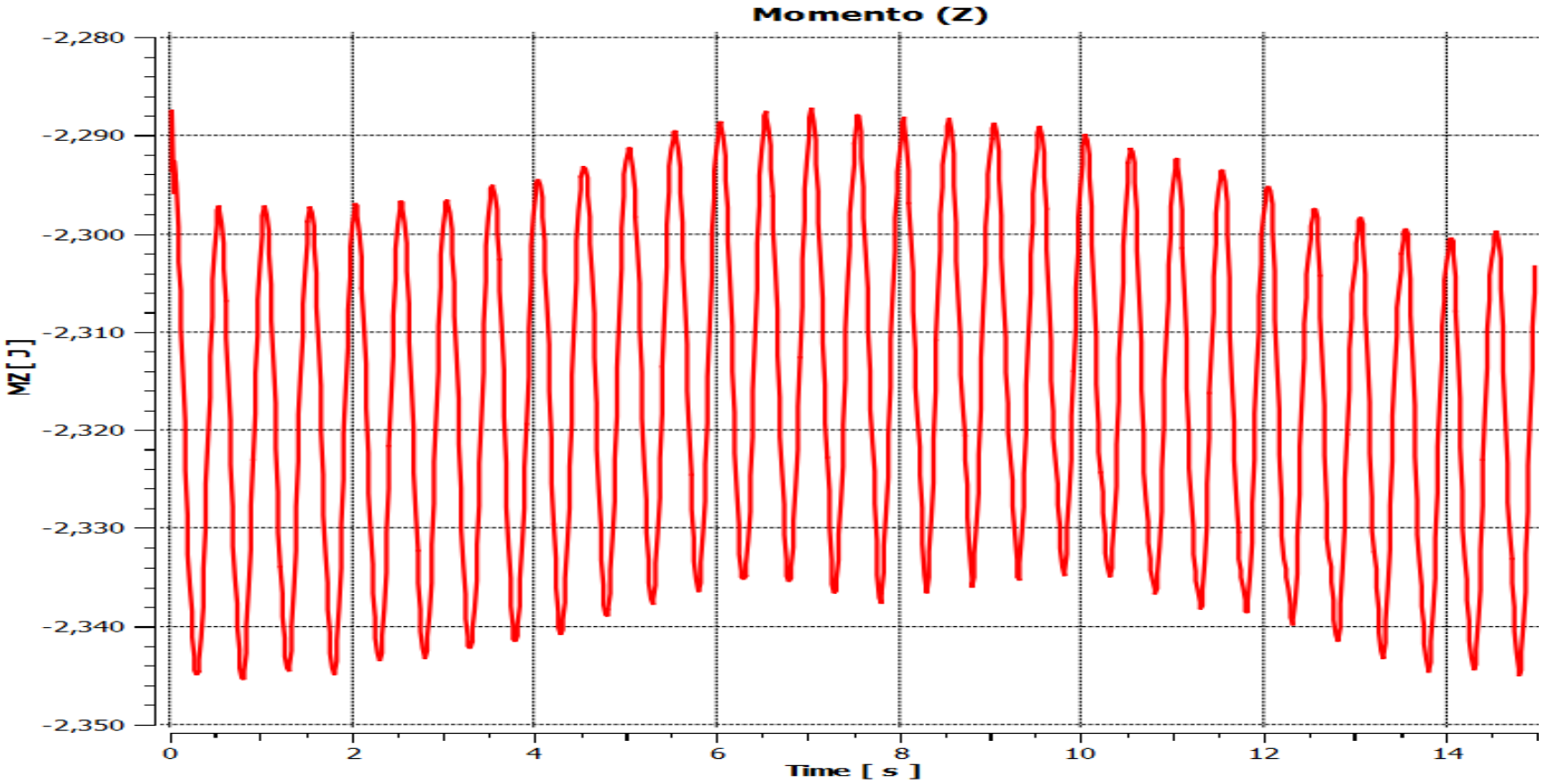
ANEXO A: Representación de las cargas a lo largo del tiempo (ÁLABE)



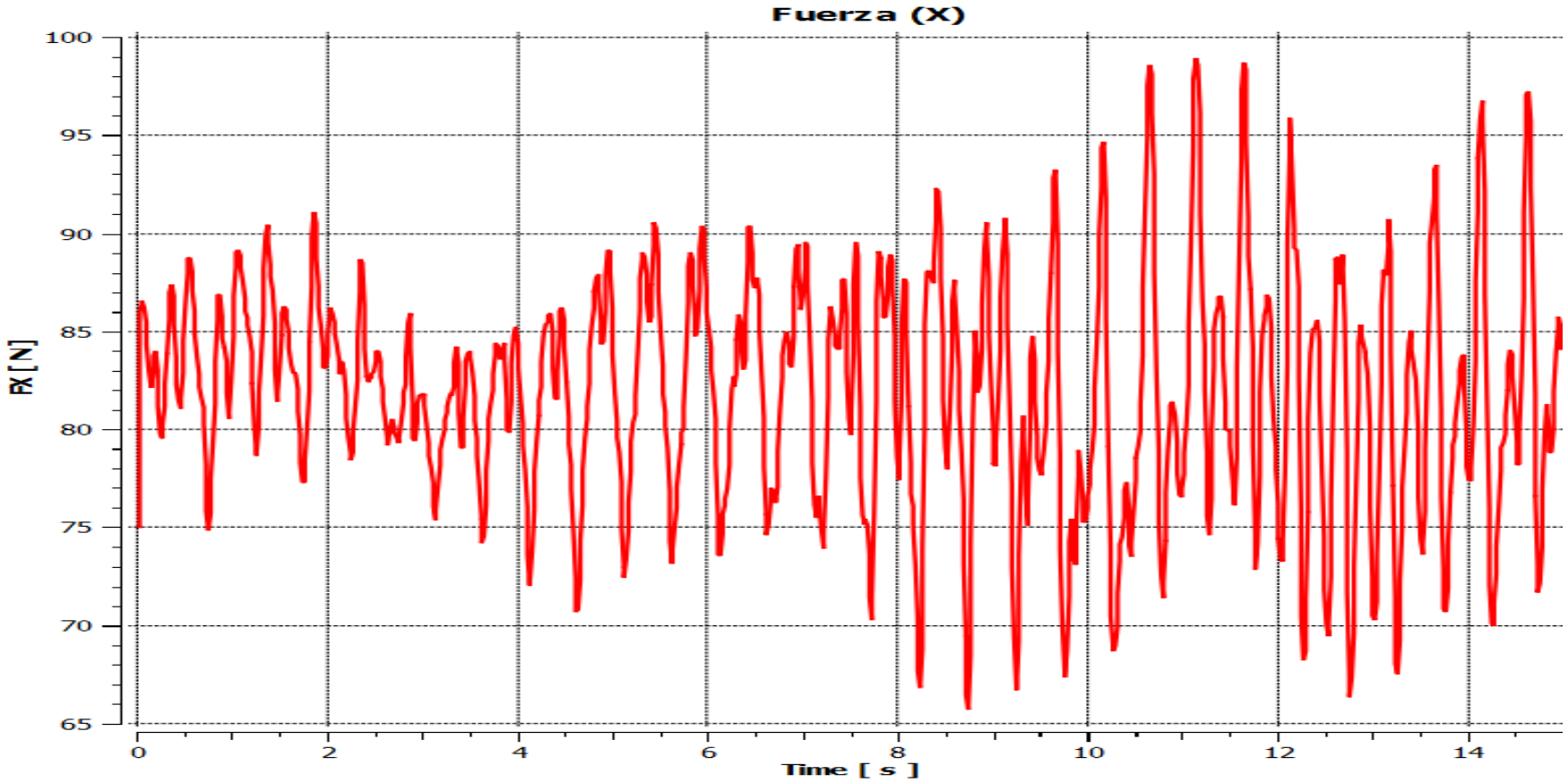
Curva Momento (Mx) vs Tiempo (T)



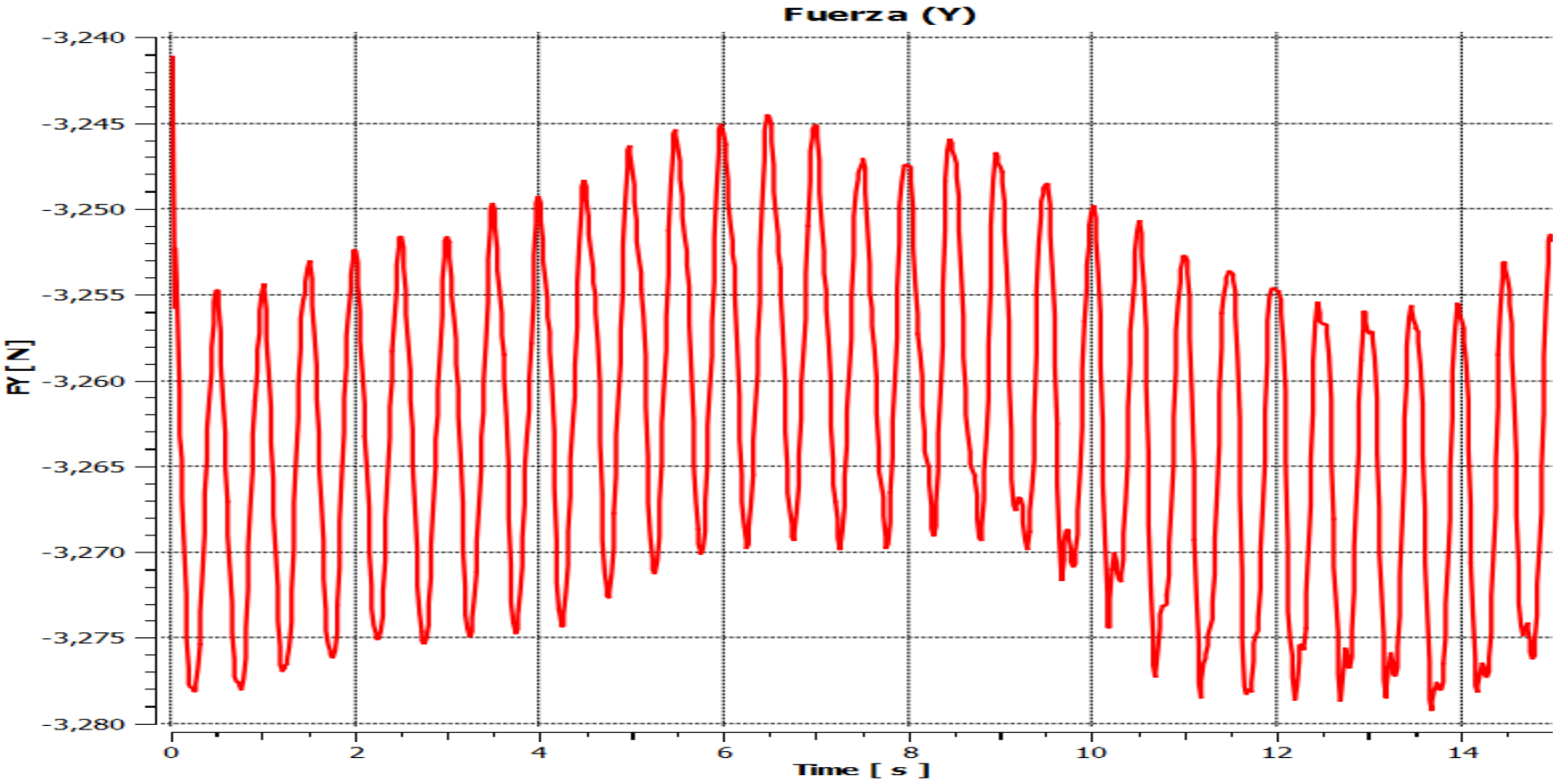
Curva Momento (My) vs Tiempo (T)



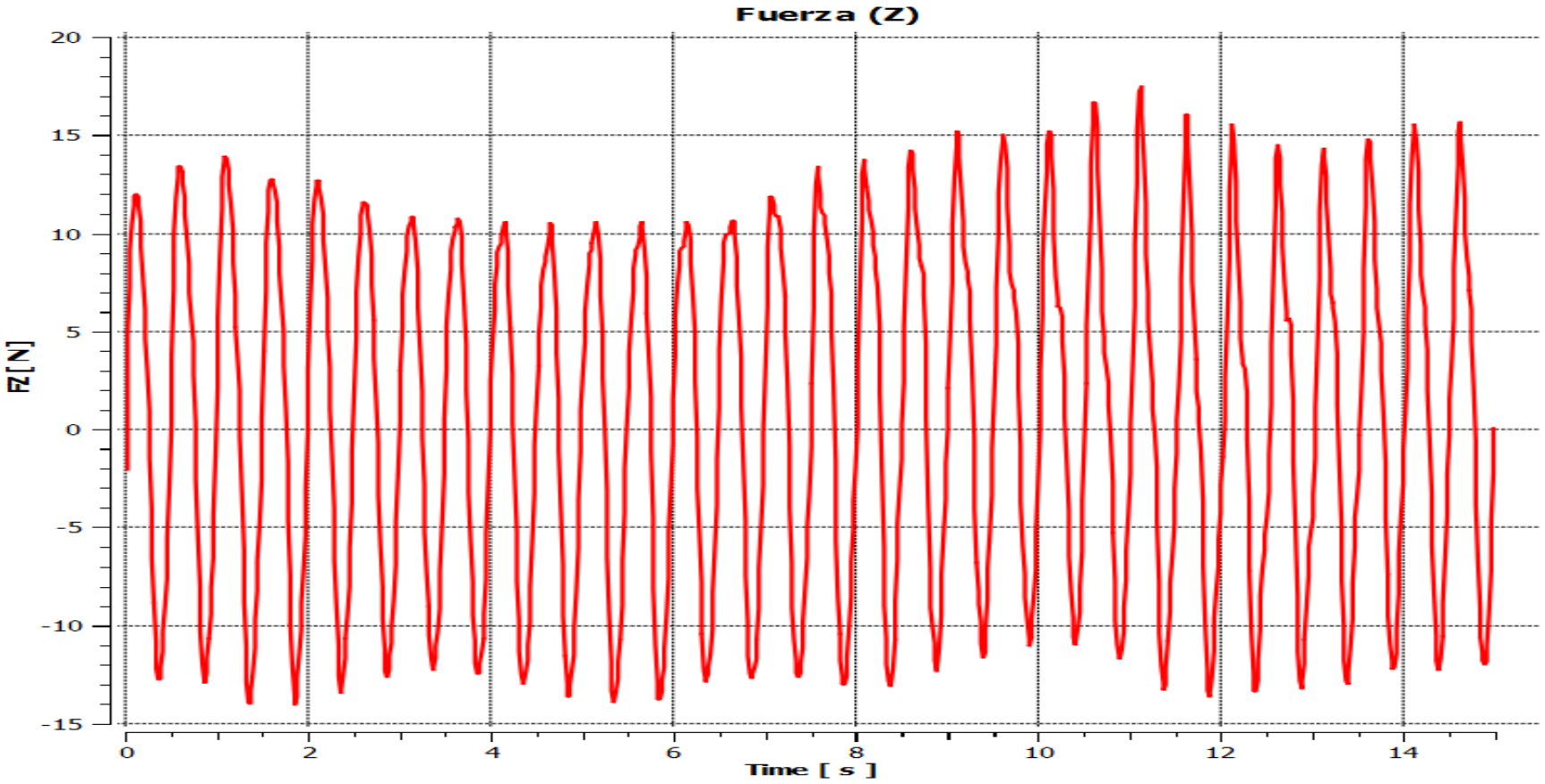
Curva Momento (Mz) vs Tiempo (T)



Curva Fuerza (Fx) vs Tiempo (T)

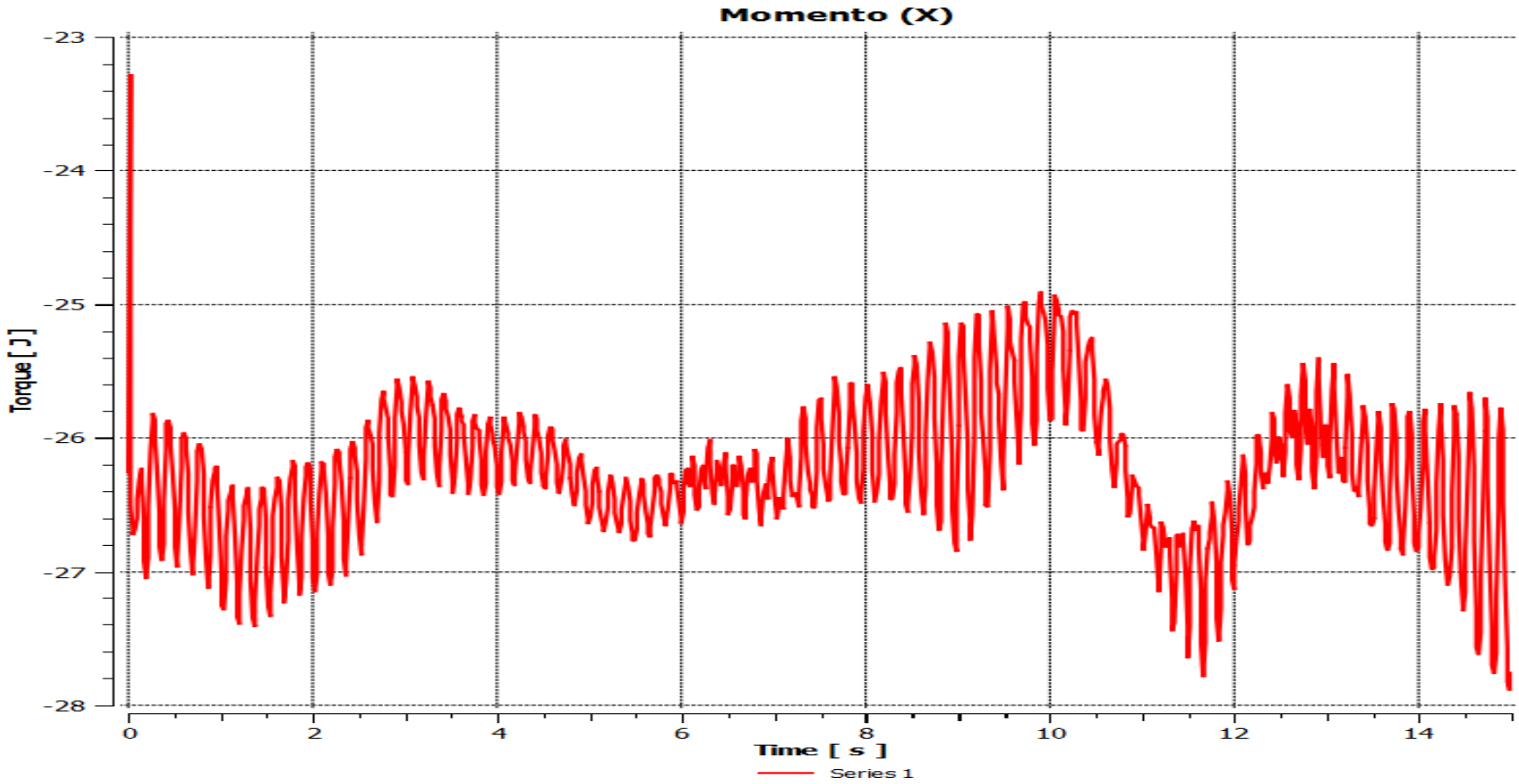


Curva Fuerza (Fy) vs Tiempo (T)

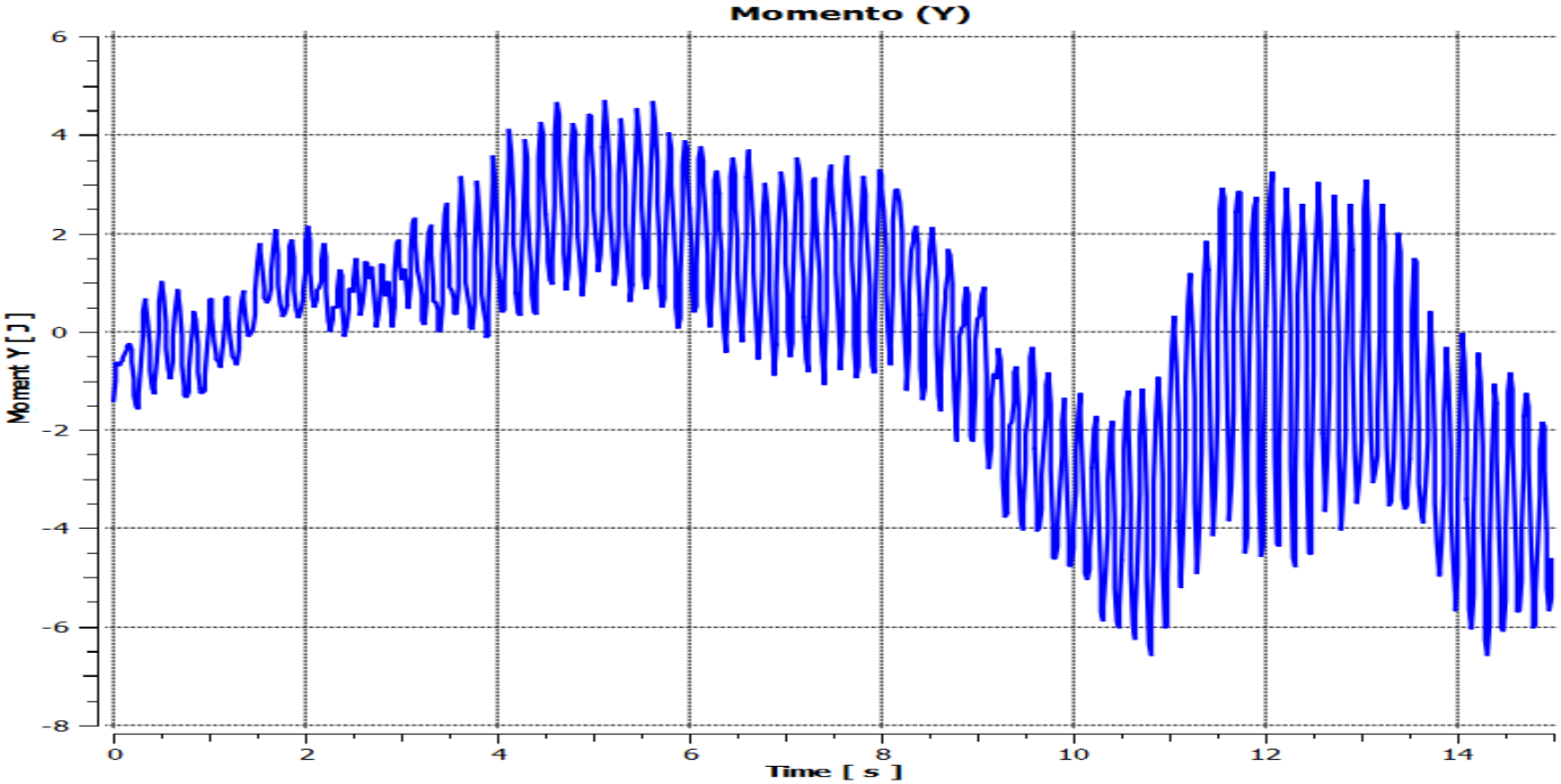


Curva Fuerza (Fz) vs Tiempo (T)

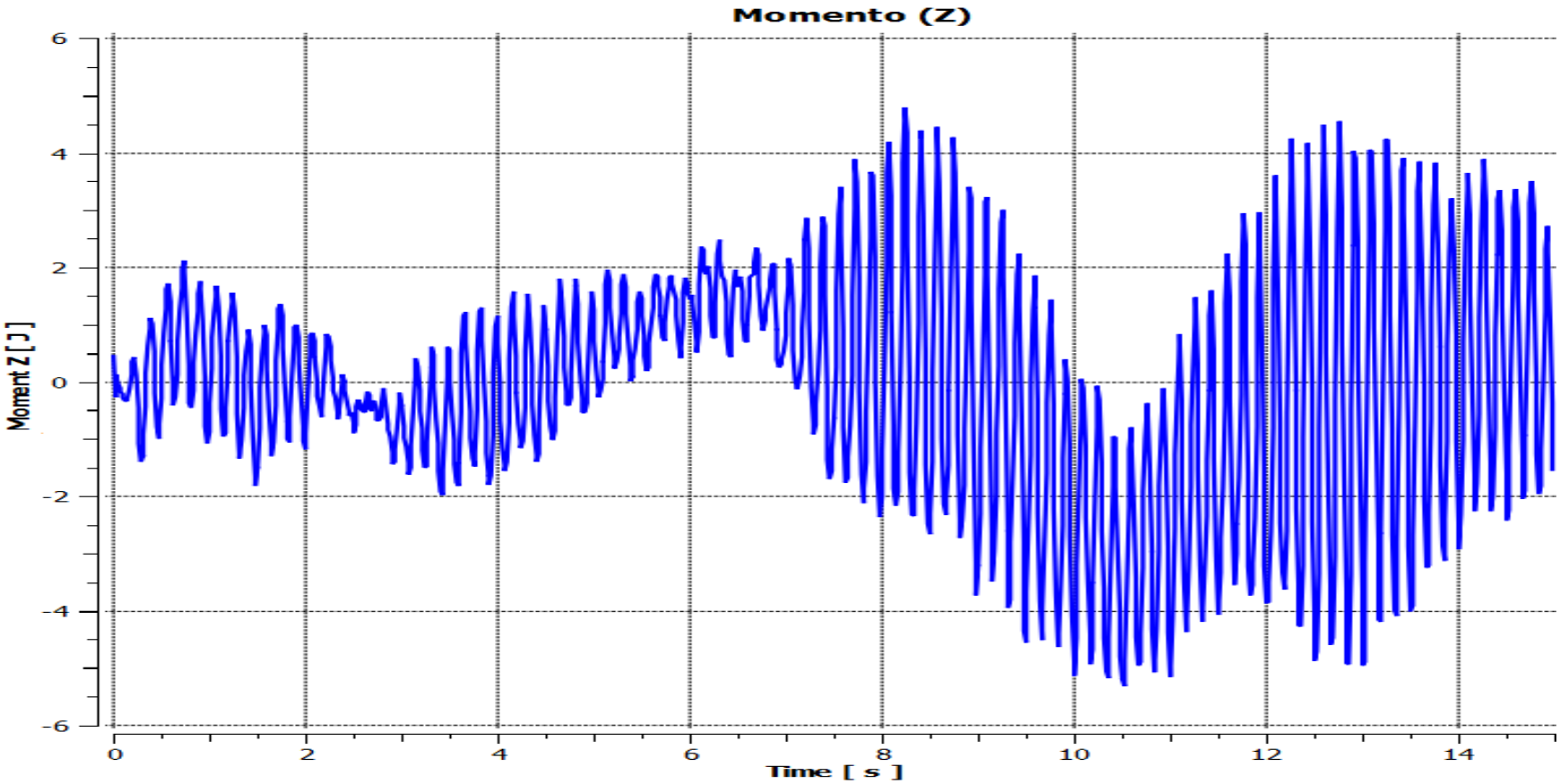
ANEXO B: Representación de las cargas a lo largo del tiempo (IMPULSOR)



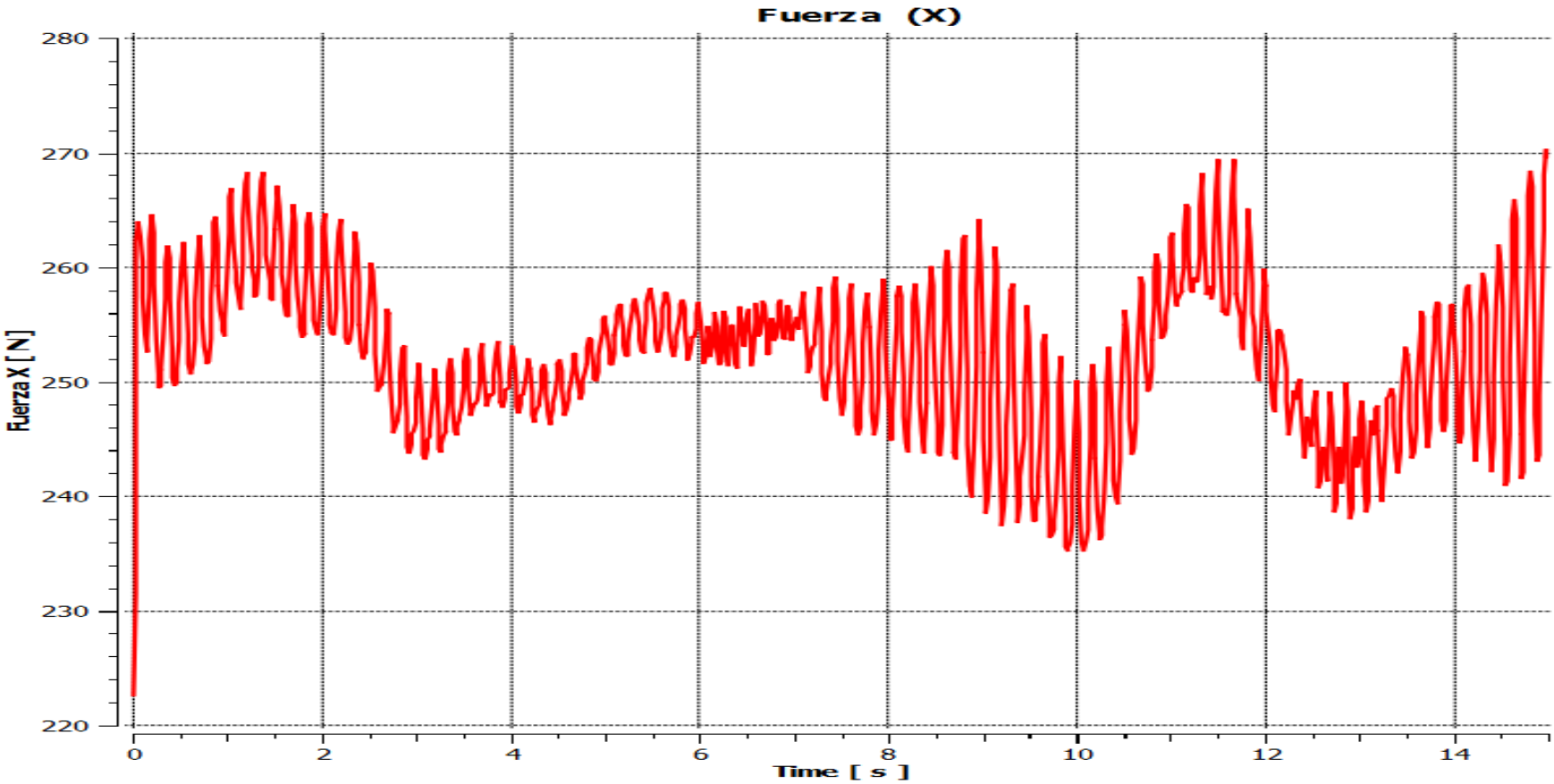
Curva Momento (Mx) vs Tiempo (T)



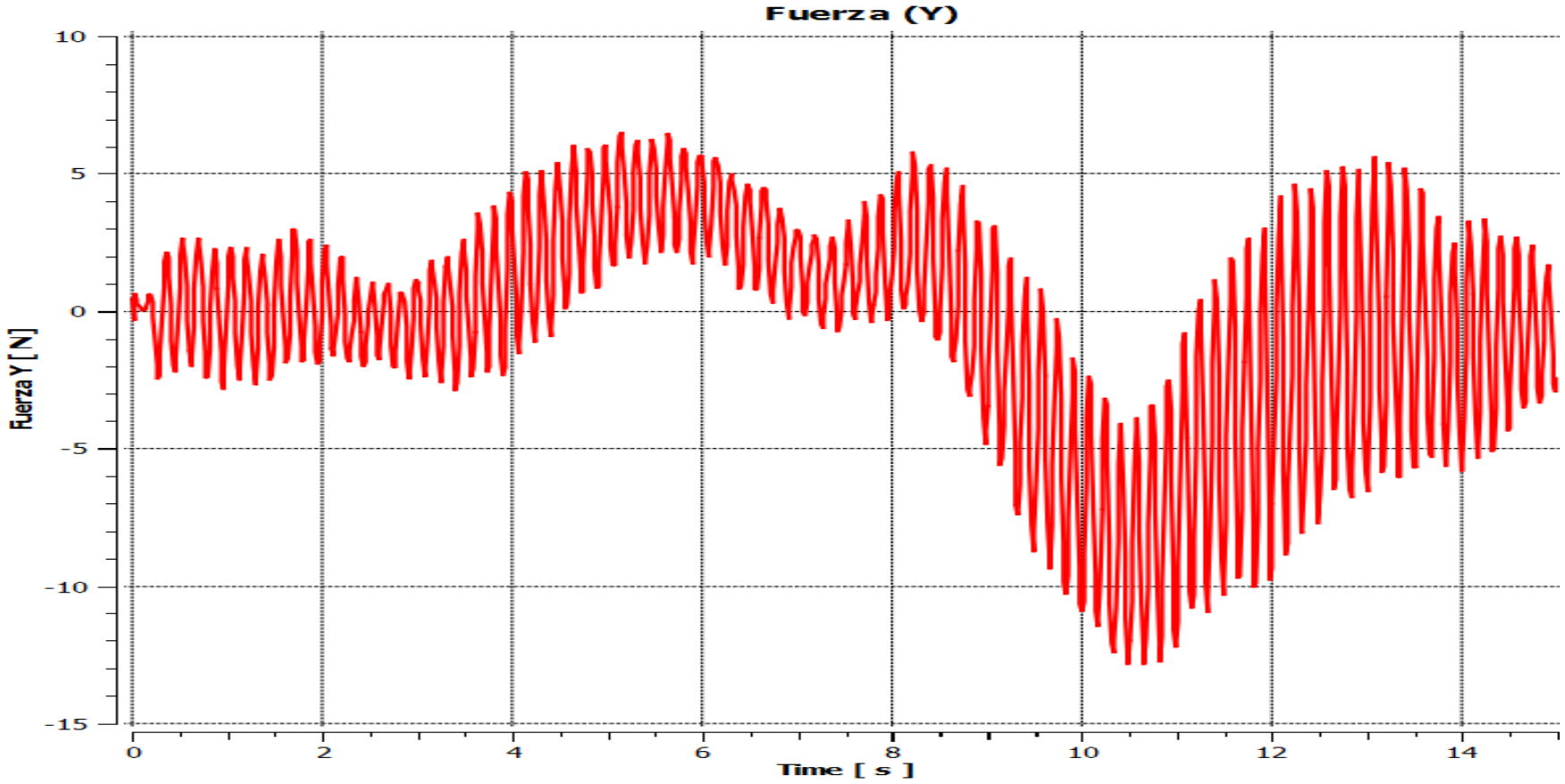
Curva Momento (My) vs Tiempo (T)



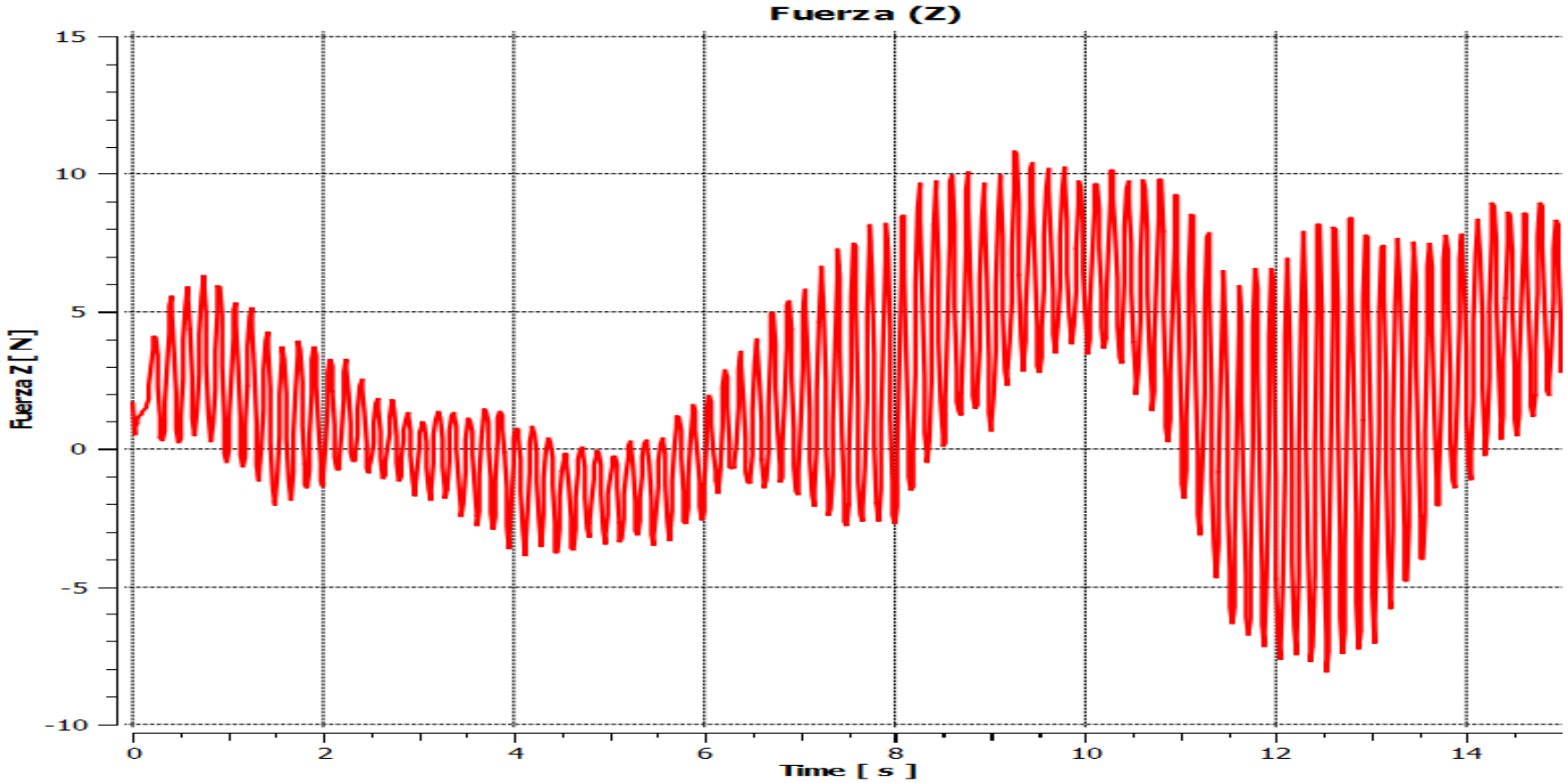
Curva Momento (Mz) vs Tiempo (T)



Curva Fuerza (Fx) vs Tiempo (T)



Curva Fuerza (Fy) vs Tiempo (T)



Curva Fuerza (Fz) vs Tiempo (T)

ANEXO C: Fluctuación de esfuerzos máximos (ÁLABE)

T	σ_p
p = 0.25s	***Mpa***
1	19.59
2	43.68
3	20.03
4	43.18
5	19.92
6	43.06
7	16.67
8	42.94
9	19.72
10	43.1
11	19.54
12	42.93
13	19.3
14	43.13
15	18.72
16	43.41
17	18.69
18	43.75
19	18.76
20	43.53
21	19.14
22	42.94
23	20.05
24	42.81
25	19.82
26	42.94
27	19.49
28	43.33
29	19.01
30	43.2
31	19.01
32	43.47

ANEXO D: Características de tubería normalizada.

Tecnituberias

Importadores - Distribuidores

Tuberia en acero

LINE PIPE - TUBING - CASING

TUBERIA ACERO AL CARBON SCH 20, 30, 40, 60, 80, 120, 160

ASTM A500 - ASTM A53 - ASTM A106 - API 5L - GRADOS A, B, C, X42, X65, X80

ESPECIFICACIONES TUBERIA LINE PIPE								
Diámetro Nominal	Cédula Calibre	Diámetro Ext.		Diámetro Int.		Espesor		Peso
		Pulg.	m.m.	Pulg.	m.m.	Pulg.	m.m.	Kg x Mt
1/8"	40	0.405"	10.29	0.269"	6.83	0.068"	1.73	0.357
	70	0.405"	10.29	0.215"	5.46	0.095"	2.41	0.461
1/4"	40	0.540"	13.72	0.364"	9.25	0.088"	2.24	0.625
	80	0.540"	13.72	0.302"	7.67	0.119"	3.02	0.804
3/8"	40	0.675"	17.15	0.493"	12.52	0.091"	2.31	0.846
	80	0.675"	17.15	0.439"	10.74	0.126"	3.20	1.101
1/2"	40	0.840"	21.34	0.622"	15.80	0.109"	2.77	1.265
	80	0.840"	21.34	0.546"	13.87	0.147"	3.73	1.622
	160	0.840"	21.34	0.466"	11.84	0.167"	4.75	1.935
	XXS	0.840"	21.34	0.252"	6.40	0.294"	7.47	2.544
3/4"	40	1.050"	26.67	0.824"	20.93	0.113"	2.87	1.682
	80	1.050"	26.67	0.742"	18.85	0.154"	3.91	2.188
	160	1.050"	26.67	0.614"	15.80	0.218"	3.54	2.887
	XXS	1.050"	26.67	0.434"	11.02	0.308"	7.82	3.631
1"	40	1.315"	33.40	1.049"	26..64	0.133"	3.38	2.500
	80	1.315"	33.40	0.957"	24.31	0.179"	4.55	3.229
	160	1.315"	33.40	0.815"	20.70	0.250"	6.35	4.226
	XXS	1.315"	33.40	0.599"	15.21	0.358"	9.09	5.446
1.1/4"	40	1.660"	42.16	1.380"	35.05	0.140"	3.56	3.378
	80	1.660"	42.16	1.278"	32.46	0.191"	4.85	4.464
	160	1.660"	42.16	1.160"	29.46	0.250"	6.35	5.595
	XXS	1.660"	42.16	0.896"	22.76	0.382"	9.70	7.752
1.1/2"	40	1.900"	48.26	1.610"	40.89	0.145"	3.68	4.084
	80	1.900"	48.26	1.500"	38.10	0.200"	5.08	5.402
	160	1.900"	48.26	1.338"	33.99	0.281"	7.14	7.232
	XXS	1.900"	48.26	1.100"	27.94	0.400"	10.16	9.538
2"	40	2.375"	60.33	2.067"	52.50	0.154"	3.91	5.435
	80	2.375"	60.33	1.939"	49.25	0.218"	5.54	7.471
	160	2.375"	60.33	1.639"	42.90	0.343"	8.71	11.072
	XXS	2.375"	60.33	1.503"	38.18	0.436"	11.07	13.437
2.1/2"	40	2.875"	73.03	2.469"	62.71	0.203"	5.16	8.616
	80	2.875"	73.03	2.323"	59.00	0.276"	7.01	11.399
	160	2.875"	73.03	2.125"	53.98	0.375"	9.53	14.896
	XXS	2.875"	73.03	1.771"	44.98	0.552"	14.02	20.386
3"	40	3.500"	88.90	3.068"	77.93	0.216"	5.40	11.280
	80	3.500"	88.90	2.000"	73.86	0.300"	7.62	15.254
	160	3.500"	88.90	2.625"	66.68	0.438"	11.13	21.310
	XXS	3.500"	88.90	2.300"	58.42	0.600"	15.24	27.647
3.1/2"	40	4.000"	101.60	3.548"	90.12	0.226"	5.74	13.557
	80	4.000"	101.60	3.364"	85.45	0.318"	8.08	18.617
	160	4.000"	101.60					
	XXS	4.000"	101.60	2.728"	69.29	0.636"	16.15	32.906

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ANEXO E: Fluctuación de las cargas máximas (IMPULSOR)

PARÁMETROS DE ENTRADA						
t	***Fuerza***			***Momentos***		
p = 0.083s	***F_X(N)***	***Fy (N)***	***Fz (N)***	***Mx (N.m)***	***My (N.m)***	***Mz (N.m)***
1	255	3.0	6.0	-26.2	3.3	2.3
2	258	0.0	-2.0	-26.5	-0.5	0.0
3	251	3.0	6.5	-26.0	3.5	2.5
4	259	-0.5	-2.5	-26.5	-1.0	-1.0
5	248	3.0	7.0	-25.8	3.0	2.5
6	259	-1.0	-3.0	-26.5	-1.0	-1.8
7	247	3.0	7.5	-25.5	3.5	3.5
8	259	-0.5	-2.5	-26.4	-1.0	-1.8
9	246	4.0	8.0	-25.6	3.5	4.0
10	258	-0.5	-2.5	-26.5	-1.0	-2.0
11	246	4.0	8.0	-25.6	3.0	3.5
12	259	-0.5	-2.5	-26.5	-1.0	-2.5
13	245	5.0	8.5	-25.5	3.3	4.3
14	258	0.0	-1.5	-26.5	-0.8	-2.3
15	243	6.0	9.5	-25.5	3.0	4.8
16	258	-0.5	-0.5	-26.6	-1.3	-2.5
17	243	5.5	10.0	-25.4	2.3	4.5
18	260	-1.0	0.0	-26.6	-1.5	-2.5
19	243	5.0	10.0	-25.3	2.3	4.5
20	262	-2.0	1.0	-26.7	-1.5	-2.3
21	243	4.5	10.0	-25.2	1.5	4.3
22	263	-3.0	1.5	-26.8	-2.3	-2.3
23	240	3.0	9.5	-25.2	1.0	3.8
24	264	-5.0	0.5	-26.8	-2.3	-2.8
25	239	3.0	10.0	-25.1	1.0	3.3
26	262	-5.5	2.5	-26.7	-2.8	-3.8
27	238	2.0	11.0	-25	-0.3	3.0
28	258	-7.0	3.0	-26.5	-3.8	-3.5
29	238	1.0	10.5	-25	-0.8	2.3
30	257	-8.5	3.0	-26.4	-4.0	-4.0
31	238	1.0	10.0	-25	-0.3	1.8
32	254	-9.0	3.5	-26.2	-4.0	-4.5

PARÁMETROS DE ENTRADA						
t	Fuerza			Momentos		
p = 0.083s	Fx (N)	Fy (N)	Fz (N)	Mx (N.m)	My (N.m)	Mz (N.m)
33	236	0.0	10.0	-25	-0.8	1.5
34	252	-10.0	4.0	-26	-4.5	-4.5
35	235	-2.0	10.0	-24.9	-1.5	0.5
36	250	-11.0	3.5	-25.9	-4.8	-4.5
37	235	-2.5	10.0	-24.9	-1.3	0.0
38	252	-11.5	3.5	-25.9	-5.0	-5.3
39	236	-3.0	10.0	-25	-1.8	0.0
40	253	-12.5	3.0	-25.9	-6.0	-5.0
41	240	-4.0	10.0	-25.2	-1.8	-1.0
42	256	-13.0	2.0	-26.2	-6.0	-5.3
43	244	-4.0	10.0	-25.6	-1.3	-0.8
44	259	-13.0	1.5	-26.4	-6.3	-5.3
45	250	-3.5	10.0	-26	-1.3	-0.3
46	261	-12.5	0.0	-26.6	-6.5	-5.0
47	254	-2.5	9.5	-26.3	-1.0	0.0
48	263	-12.0	-2.0	-26.8	-6.0	-5.0
49	257	-1.0	8.5	-26.5	0.3	1.0
50	265	-11.0	-3.0	-27.2	-5.0	-4.5
51	258	0.5	8.0	-26.6	1.3	1.0
52	268	-11.0	-5.0	-27.4	-5.0	-4.3
53	257	1.0	6.5	-26.7	2.0	1.5
54	270	-10.0	-6.5	-27.6	-4.0	-4.0
55	256	2.0	6.0	-26.6	3.0	1.5
56	270	-9.5	-6.5	-27.8	-3.8	-3.5
57	253	2.5	6.5	-26.5	2.8	2.3
58	265	-10.0	-7.0	-27.5	-4.5	-3.8
59	250	3.0	6.5	-26.3	2.8	3.0
60	260	-10.0	-7.5	-27.1	-4.5	-3.8
61	247	4.0	6.0	-26.1	3.3	3.0
62	254	-9.0	-7.0	-26.8	-4.3	-3.8
63	245	4.5	8.0	-26	3.0	3.5
64	250	-8.0	-7.5	-26.4	-4.5	-3.5

PARÁMETROS DE ENTRADA						
t	Fuerza			Momentos		
p = 0.083s	Fx (N)	Fy (N)	Fz (N)	Mx (N.m)	My (N.m)	Mz (N.m)
65	244	4.5	8.0	-25.8	2.5	4.3
66	249	-7.5	-8.0	-26.3	-4.5	-4.3
67	241	5.0	8.0	-25.6	3.0	4.3
68	249	-6.5	-7.5	-26.3	-3.5	-5.0
69	239	5.0	8.5	-25.4	2.8	4.5
70	250	-6.5	-7.0	-26.4	-4.0	-4.5
71	238	5.0	8.0	-25.4	2.5	4.5
72	248	-6.5	-7.0	-26.3	-3.5	-5.0
73	239	6.0	7.5	-25.4	3.0	4.0
74	248	-6.0	-6.0	-26.3	-3.0	-5.0
75	240	5.5	7.5	-25.5	3.0	4.0
76	250	-6.0	-5.0	-26.4	-3.5	-4.0
77	242	5.0	7.5	-25.8	2.5	4.3
78	253	-6.0	-4.0	-26.6	-3.5	-4.0
79	243	4.5	7.5	-25.8	2.0	4.0
80	256	-5.5	-2.0	-26.8	-3.5	-4.0
81	244	3.0	8.0	-25.7	1.5	3.8
82	257	-5.5	-1.5	-26.8	-4.0	-3.3
83	245	2.0	8.0	-25.8	0.5	3.8
84	257	-6.0	-1.0	-26.8	-5.0	-3.3
85	244	3.0	8.5	-25.8	-0.3	3.3
86	258	-5.5	0.0	-27	-5.5	-3.0
87	243	3.0	9.0	-25.8	0.0	3.5
88	260	-5.0	0.5	-27.1	-6.0	-2.3
89	242	2.5	8.5	-25.8	-0.5	4.0
90	262	-4.5	0.5	-27.3	-6.5	-2.3
91	241	2.5	8.5	-25.7	-1.0	3.3
92	266	-3.5	1.0	-27.6	-6.0	-2.5
93	242	2.5	9.0	-25.7	-1.0	3.3
94	268	-3.5	2.0	-27.7	-5.5	-2.0
95	243	1.5	8.5	-25.8	-1.3	3.5
96	270	-3.0	3.0	-27.9	-6.0	-2.0

ANEXO F: Fluctuación de las cargas máximas (BRIDA)

PARÁMETROS DE ENTRADA						
t	***Esfuerzo normal***			***Esfuerzos cortantes***		
p = 0.083s	***Fx (N)***	***Fy (N)***	***Fz (N)***	***Mx (N.m)***	***My (N.m)***	***Mz (N.m)***
1	255	3.0	6.0	-26.2	16.4	-4.3
2	258	0.0	-2.0	-26.5	-4.9	0.0
3	251	3.0	6.5	-26	17.7	-4.1
4	259	-0.5	-2.5	-26.5	-6.5	0.1
5	248	3.0	7.0	-25.8	18.3	-4.1
6	259	-1.0	-3.0	-26.5	-7.6	0.4
7	247	3.0	7.5	-25.5	19.9	-3.1
8	259	-0.5	-2.5	-26.4	-6.5	-0.7
9	246	4.0	8.0	-25.6	21.0	-4.8
10	258	-0.5	-2.5	-26.5	-6.5	-0.9
11	246	4.0	8.0	-25.6	20.5	-5.3
12	259	-0.5	-2.5	-26.5	-6.5	-1.4
13	245	5.0	8.5	-25.5	21.9	-6.7
14	258	0.0	-1.5	-26.5	-4.0	-2.3
15	243	6.0	9.5	-25.5	23.8	-8.4
16	258	-0.5	-0.5	-26.6	-2.3	-1.4
17	243	5.5	10.0	-25.4	24.2	-7.5
18	260	-1.0	0.0	-26.6	-1.5	-0.3
19	243	5.0	10.0	-25.3	24.2	-6.5
20	262	-2.0	1.0	-26.7	0.7	2.1
21	243	4.5	10.0	-25.2	23.4	-5.6
22	263	-3.0	1.5	-26.8	1.0	4.3
23	240	3.0	9.5	-25.2	21.8	-2.8
24	264	-5.0	0.5	-26.8	-1.2	8.2
25	239	3.0	10.0	-25.1	22.9	-3.3
26	262	-5.5	2.5	-26.7	2.7	8.3
27	238	2.0	11.0	-25	23.8	-1.4
28	258	-7.0	3.0	-26.5	2.8	11.8
29	238	1.0	10.5	-25	22.2	0.1
30	257	-8.5	3.0	-26.4	2.6	14.6
31	238	1.0	10.0	-25	21.7	-0.4
32	254	-9.0	3.5	-26.2	3.7	15.2

PARÁMETROS DE ENTRADA						
t	Esfuerzo normal			Esfuerzos cortantes		
p = 0.083s	Fx (N)	Fy (N)	Fz (N)	Mx (N.m)	My (N.m)	Mz (N.m)
33	236	0.0	10.0	-25	21.2	1.5
34	252	-10.0	4.0	-26	4.3	17.4
35	235	-2.0	10.0	-24.9	20.4	4.9
36	250	-11.0	3.5	-25.9	2.9	19.6
37	235	-2.5	10.0	-24.9	20.7	5.5
38	252	-11.5	3.5	-25.9	2.7	19.9
39	236	-3.0	10.0	-25	20.2	6.6
40	253	-12.5	3.0	-25.9	0.6	22.4
41	240	-4.0	10.0	-25.2	20.2	7.8
42	256	-13.0	2.0	-26.2	-1.6	23.2
43	244	-4.0	10.0	-25.6	20.7	8.0
44	259	-13.0	1.5	-26.4	-3.0	23.2
45	250	-3.5	10.0	-26	20.7	7.4
46	261	-12.5	0.0	-26.6	-6.5	22.4
47	254	-2.5	9.5	-26.3	19.8	5.5
48	263	-12.0	-2.0	-26.8	-10.4	21.3
49	257	-1.0	8.5	-26.5	18.9	3.2
50	265	-11.0	-3.0	-27.2	-11.6	19.6
51	258	0.5	8.0	-26.6	18.8	-0.1
52	268	-11.0	-5.0	-27.4	-16.0	19.8
53	257	1.0	6.5	-26.7	16.2	-0.7
54	270	-10.0	-6.5	-27.6	-18.2	17.9
55	256	2.0	6.0	-26.6	16.1	-2.9
56	270	-9.5	-6.5	-27.8	-18.0	17.3
57	253	2.5	6.5	-26.5	17.0	-3.2
58	265	-10.0	-7.0	-27.5	-19.8	18.2
59	250	3.0	6.5	-26.3	17.0	-3.6
60	260	-10.0	-7.5	-27.1	-20.9	18.2
61	247	4.0	6.0	-26.1	16.4	-5.8
62	254	-9.0	-7.0	-26.8	-19.6	16.0
63	245	4.5	8.0	-26	20.5	-6.4
64	250	-8.0	-7.5	-26.4	-20.9	14.0

PARÁMETROS DE ENTRADA						
t	Esfuerzo normal			Esfuerzos cortantes		
p = 0.083s	Fx (N)	Fy (N)	Fz (N)	Mx (N.m)	My (N.m)	Mz (N.m)
65	244	4.5	8.0	-25.8	20.0	-5.6
66	249	-7.5	-8.0	-26.3	-22.0	12.2
67	241	5.0	8.0	-25.6	20.5	-6.7
68	249	-6.5	-7.5	-26.3	-19.9	9.2
69	239	5.0	8.5	-25.4	21.4	-6.5
70	250	-6.5	-7.0	-26.4	-19.3	9.7
71	238	5.0	8.0	-25.4	20.0	-6.5
72	248	-6.5	-7.0	-26.3	-18.8	9.2
73	239	6.0	7.5	-25.4	19.4	-9.1
74	248	-6.0	-6.0	-26.3	-16.1	8.1
75	240	5.5	7.5	-25.5	19.4	-8.0
76	250	-6.0	-5.0	-26.4	-14.5	9.1
77	242	5.0	7.5	-25.8	18.9	-6.7
78	253	-6.0	-4.0	-26.6	-12.3	9.1
79	243	4.5	7.5	-25.8	18.4	-5.9
80	256	-5.5	-2.0	-26.8	-7.9	8.0
81	244	3.0	8.0	-25.7	19.0	-2.8
82	257	-5.5	-1.5	-26.8	-7.3	8.8
83	245	2.0	8.0	-25.8	18.0	-0.6
84	257	-6.0	-1.0	-26.8	-7.2	9.9
85	244	3.0	8.5	-25.8	18.4	-3.3
86	258	-5.5	0.0	-27	-5.5	9.0
87	243	3.0	9.0	-25.8	19.7	-3.1
88	260	-5.0	0.5	-27.1	-4.9	8.7
89	242	2.5	8.5	-25.8	18.1	-1.5
90	262	-4.5	0.5	-27.3	-5.4	7.6
91	241	2.5	8.5	-25.7	17.6	-2.2
92	266	-3.5	1.0	-27.6	-3.8	5.2
93	242	2.5	9.0	-25.7	18.7	-2.2
94	268	-3.5	2.0	-27.7	-1.1	5.7
95	243	1.5	8.5	-25.8	17.4	0.2
96	270	-3.0	3.0	-27.9	0.6	4.6

ANEXO G: Fluctuación de esfuerzos máximos (BRIDA)

T	σ_p
$p = 0.083s$	Kpa
1	1082.5
2	500.2
3	999.4
4	547.5
5	522.4
6	748.3
7	118.7
8	811.6
9	200.1
10	744.3
11	778.3
12	578.6
13	1245.1
14	523.4
15	1084.3
16	568.5
17	427.1
18	647.2
19	-27.9
20	615.1
21	155.2
22	517.2
23	711.4
24	423.4
25	1223.4
26	708.7
27	1181.3
28	953.6
29	635.7
30	945.9
31	113.8
32	533.5

T	σ_p
$p = 0.083s$	Kpa
33	111.2
34	162.4
35	500.2
36	208.8
37	1049.4
38	707.1
39	1202.6
40	1173.2
41	846.8
42	1207.7
43	253.4
44	715.3
45	41.9
46	191.8
47	483.9
48	-13.7
49	1038.3
50	316.7
51	1078.5
52	886.5
53	615.1
54	1309.1
55	211.2
56	1127.2
57	274.9
58	474.9
59	731.9
60	-83.9
61	1102.2
62	97.1
63	1034.2
64	680.1

T	σ_p
$p = 0.083s$	Kpa
65	480.3
66	1225.1
67	54.8
68	1180.4
69	213.9
70	667.9
71	810.9
72	156.5
73	1220.7
74	191.4
75	985.0
76	653.0
77	450.3
78	1019.2
79	116.2
80	850.1
81	221.0
82	525.0
83	651.3
84	300.6
85	1115.7
86	483.2
87	1060.0
88	773.4
89	593.6
90	888.7
91	185.2
92	738.5
93	220.2
94	514.8
95	628.1
96	533.3