Supporting Information for "Two classes of equatorial magnetotail dipolarization fronts observed by Magnetospheric Multiscale Mission: A statistical overview"

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Key Points:

- We reveal a new class of DF related to a bump of the magnetic field associated with a minimum in the ion and electron pressures.
- The energy conversion process in the S/C frame is driven by the diamagnetic current dominated by the ion pressure gradient.
- The energy conversion processes are not homogeneous at the electron scale due to the variations of the electric fields.

1 Supplementary material

References

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Table 1. MMS located RE [GSE]

#	day	UT	R_E (X,Y,Z)	#	day	UT	R_E (X,Y,Z)
1	05-19	03:06:42	-10.55,-3.6,0.06	51	07-26	11:31:44	-23.54 , 6.85 , 5.42
2	05-19	09:46:58	-15.19,-9.03,1.54	52	07-28	20:00:06	-20.52 , 9.66 , 4.2
3	05-19	10:00:53	-15.3,-9.18,1.58	53	07-28	20:10:46	-20.59 , 9.65 , 4.22
4	05-22	08:29:35	-17.04 , -10.49 , 2.25	54	07-29	08:16:50	-23.29 , 7.55 , 5.56
5	05-28	00:35:14	-18.49 , -9.84 , 2.62	55	07-29	09:22:55	-23.32 , 7.28 , 5.63
6	05-28	00:39:00	-18.51 , -9.87 , 2.63	56	07-31	20:57:39	-21.95 , 9.91 , 5.0
7	05-28	04:35:40	-19.41 , -11.64 , 3.28	57	07-31	22:33:00	-22.3 , 9.64 , 5.17
8	05-28	04:39:08	-19.42 , -11.67 , 3.29	58	07-17	06:03:30	-16.81 , 6.89 , 2.4
9	05-28	05:03:00	-19.49 , -11.83 , 3.35	59	07-17	07:52:30	-18.13 , 6.78 , 2.78
10	05-28	05:43:18	-19.58 , -12.09 , 3.45	60	07-17	14:51:20	-21.86 , 5.9 , 4.01
11	05-28	05:54:14	-19.6 , -12.16 , 3.48	61	07-17	15:40:30	-22.18 , 5.77 , 4.14
12	05-28	06:02:32	-19.62 , -12.22 , 3.5	62	07-18	03:43:30	-24.3 , 3.23 , 5.45
13	05-28	06:05:13	-19.62 , -12.23 , 3.51	63	07-18	13:03:03	-22.88 , 0.82 , 5.78
14	05-28	06:29:40	-19.67 , -12.39 , 3.57	64	07-20	00:54:03	-16.23 , 7.61 , 2.36
15	05-28	06:34:02	-19.68 , -12.42 , 3.58	65	07-20	19:15:39	-23.94 , 5.15 , 5.19
16	05-28	06:44:07	-19.69 , -12.48 , 3.6	66	07-23	17:18:24	–23.9 , 5.57 , 5.46
17	05-28	07:04:30	-19.72 , -12.6 , 3.65	67	07-23	20:44:54	-23.86 , 4.72 , 5.68
18	05-28	14:23:19	-19.64 , -14.75 , 4.53	68	07-24	12:48:13	-18.53 , -0.05 , 5.37
19	05-28	14:26:48	-19.64 , -14.77 , 4.54	69	07-24	12:54:30	-18.47 , -0.08 , 5.35
20	05-28	15:01:00	-19.57 , -14.89 , 4.59	70	07-24	13:02:30	-18.38 , -0.12 , 5.34
21	05-28	15:04:00	-19.57 , -14.9 , 4.6	71	07-24	13:07:35	-18.32 , -0.15 , 5.33
22	05-28	15:30:18	-19.51 , -14.99 , 4.64	72	07-24	13:07:30	-18.32 , -0.15 , 5.33
23	05-28	07:14:30	-19.74 , -12.67 , 3.68	73	07-24	13:09:30	-18.3 , -0.16 , 5.33
24	05-28	14:59:00	-19.57 , -14.89 , 4.59	74	07-26	05:11:30	-22.45 , 8.09 , 4.77
25	05-28	16:13:40	-19.41 , -15.14 , 4.71	75	07-26	13:40:54	-23.65 , 6.34 , 5.57
26	06-11	17:38:35	-22.17 , -10.68 , 4.98	76	07-26	17:40:38	-23.48 , 5.31 , 5.78
27	06-19	03:56:26	-16.81 , -0.34 , 1.64	77	07-29	04:36:33	-22.93 , 8.36 , 5.26
28	08-21	13:20:50	-16.55 , 7.68 , 5.45	78	07-29	07:46:30	-23.26 , 7.67 , 5.53
29	06-24	23:18:06	-20.15 , -0.43 , 2.72	79	07-29	08:35:30	-23.3 , 7.48 , 5.58
30	06-05	14:03:11	-20.76 , -8.81 , 3.35	80	07-29	09:23:08	-23.32 , 7.28 , 5.63
31	06-11	01:58:23	-20.73 , -6.03 , 3.02	81	07-29	09:48:33	-23.33 , 7.17 , 5.66
32	06-11	17:36:34	-22.18 , -10.67 , 4.98	82	07-31	20:57:48	-21.95 , 9.91 , 4.99
33	06-14	06:48:18	-22.85 , -8.23 , 4.44	83	07-31	22:33:18	-22.3 , 9.64 , 5.17
34	06-15	02:16:10	-18.3 , -11.23 , 5.43	84	07-31	23:46:48	-22.52 , 9.41 , 5.29
35	06-16	23:49:21	-22.98 , -6.53 , 4.21	85	07-17	06:03:00	-16.81 , 6.89 , 2.4
36	06-17	00:14:00	-23.03 , -6.65 , 4.26	86	07-18	13:03:34	-22.87 , 0.82 , 5.78
37	06-17	04:14:17	-23.24 , -7.74 , 4.71	87	07-26	13:30:00	-23.64 , 6.39 , 5.56
38	06-19	03:50:31	-16.73 , -0.3 , 1.61	88	07-31	21:40:27	-22.11 , 9.79 , 5.07
39	06-19	04:05:24	-16.92 , -0.39 , 1.67	89	08-01	00:48:12	-22.67 , 9.2 , 5.38
40	06-19	05:31:14	-17.99 , -0.93 , 1.97	90	08-06	01:20:36	-16.93 , 12.27 , 3.6
41	06-19	05:38:17	-18.07 , -0.98 , 2.0	91	08-06	05:34:20	-19.01 , 12.31 , 4.3
42	06-24	23:57:17	-20.5 , -0.63 , 2.84	92	08-06	18:56:30	-22.15 , 10.37 , 5.73
43	06-25	06:11:39	-22.95 , -2.49 , 3.87	93	08-07	15:56:10	-16.17 , 2.6 , 5.01
44	07-08	21:13:03	-18.28 , 4.38 , 2.47	94	08-09	16:55:39	-21.7 , 10.6 , 5.9
45	07-11	23:25:23	-21.91 , 4.07 , 3.78	95	08-21	12:58:39	-16.72 , 7.89 , 5.49
46	07-12	11:53:20	-24.53 , 1.34 , 5.28	96	08-21	13:06:35	-16.66 , 7.82 , 5.48
47	07-18	20:00:42	-19.87 , -1.07 , 5.53	97	08-23	15:37:22	-18.63 , 15.52 , 5.98
48	07-24	12:48:03	-18.53 , -0.05 , 5.37	98	08-21	18:10:30	-13.7 , 4.58 , 4.62
49	07-24	12:54:43	-18.46 , -0.08 , 5.35				
50	07-24	13:07:04	-18.32 , -0.15 , 5.33				

Table 2. MMS located RE [GSE]

#	day	UT	R_E (X,Y,Z)	#	day	UT	R_E (X,Y,Z)
1	05-28	07:09:49	-19.73 , -12.63 , 3.66	18	07-26	04:51:30	-22.35 , 8.15 , 4.73
2	06-11	02:10:52	-20.81 , -6.11 , 3.06	19	07-26	04:51:30	-22.35 , 8.15 , 4.73
3	06-19	03:53:00	-16.76 , -0.31 , 1.62	20	07-26	04:51:30	-22.35 , 8.15 , 4.73
4	06-19	04:01:41	-16.88 , -0.37 , 1.65	21	07-26	11:42:30	-23.56 , 6.81 , 5.43
5	06-19	04:00:18	-16.86 , -0.36 , 1.65	22	07-29	10:24:00	-23.32 , 7.02 , 5.69
6	07-23	16:46:30	-23.88 , 5.69 , 5.42	23	07-29	10:24:00	-23.32 , 7.02 , 5.69
7	07-23	16:54:30	-23.88 , 5.66 , 5.43	24	07-31	23:46:48	-22.52 , 9.41 , 5.29
8	07-23	16:54:30	-23.88 , 5.66 , 5.43	25	07-31	23:46:48	-22.52 , 9.41 , 5.29
9	07-23	17:00:10	-23.89 , 5.64 , 5.44	26	07-31	23:51:20	-22.53 , 9.39 , 5.3
10	07-23	17:00:10	-23.89 , 5.64 , 5.44	27	07-31	23:51:20	-22.53 , 9.39 , 5.3
11	07-23	17:08:30	-23.9 , 5.61 , 5.45	28	07-06	09:00:00	-22.27 , 2.13 , 3.7
12	07-15	10:20:30	-24.34 , 1.67 , 5.54	29	07-06	17:46:07	-24.42 , 0.07 , 4.86
13	07-15	10:38:00	-24.31 , 1.6 , 5.55	30	07-26	07:52:28	-23.06 , 7.61 , 5.08
14	07-18	03:43:30	-24.3 , 3.23 , 5.45	31	07-26	07:52:28	-23.06 , 7.61 , 5.08
15	07-18	13:10:00	-22.84 , 0.79 , 5.78	32	07-26	11:42:24	-23.56 , 6.81 , 5.43
16	07-18	19:01:15	-20.42 , -0.8 , 5.6	33	07-06	03:07:41	-19.25 , 3.39 , 2.65
17	07-20	18:23:10	-23.82 , 5.35 , 5.1	34	07-25	22:08:45	-19.75 , 8.96 , 3.74

Table 3. The Minimum Variance Analysis Results For Class I (1)

#	$\frac{\lambda_M}{\lambda_N}$	$\frac{\lambda_L}{\lambda_N}$	L	M	N
1	10.7	105.7	0.6, 0.2, -0.7	0.02, 0.9, 0.3	0.8, -0.2, 0.6
2	16.7	43.2	0.08, 0.6, -0.7	-0.9, -0.09, -0.2	-0.2, 0.7, 0.66
3	2.9	17.8	0.01, 0.05, 0.9	-0.5, -0.8, 0.05	0.8, -0.5, 0.01
4	6.2	38.2	0.5, -0.2, 0.8	0.8, 0.2, -0.5	-0.06, 0.9, 0.3
5	11.3	52	0.5, 0.6, 0.7	-0.7, -0.1, 0.6	0.5, -0.8, 0.3
6	2.4	40.1	0.4, 0.3, -0.9	0.09, 0.9, 0.3	0.9, -0.2, 0.3
7	12.9	150.5	0.2, -0.5, 0.9	0.1, 0.9, 0.4	-0.9, 0.05, 0.2
8	3.9	69	0.2, 0.4, 0.9	-0.6, -0.7, 0.5	0.8, -0.6, 0.1
9	1.4	52.7	0.5, 0.2, 0.8	0.5, 0.7, -0.5	-0.6, 0.7, 0.2
10	13.7	94.9	0.5, 0.2, 0.9	0.4, 0.8, -0.4	-0.7, 0.6, 0.3
11	37.3	457	0.5, 0.3, 0.8	0.3, 0.8, -0.5	-0.8, 0.5, 0.3
12	6.2	37.4	0.3, -0.6, -0.8	0.8, -0.2, 0.5	-0.4, -0.8, 0.4
13	3.5	24.1	0.2, -0.05, 0.9	-0.5, 0.8, 0.1	-0.8, -0.5, 0.1
14	8.8	322.7	0.1, -0.6, 0.7	0.3, 0.7, 0.6	-0.9, 0.1, 0.3
15	33.9	159.9	0.2, -0.4, 0.9	0.6, 0.8, 0.2	-0.8, 0.5, 0.3
16	17.4	74.7	0.5, 0.01, -0.8	-0.2, 0.9, -0.1	0.8, 0.3, 0.5
17	5.9	32.4	0.3, 0.2, 0.9	0.1, 0.9, -0.3	-0.9, 0.2, 0.2
18	14.3	132.4	0.5, 0.03, -0.9	-0.8, 0.2, -0.5	0.2, 0.9, 0.1
19	26.8	68.8	0.2, -0.1, 0.9	0.9, 0.3, -0.2	-0.3, 0.9, 0.2
20	42.5	1143.3	0.4, 0.05, 0.9	0.05, 0.9, -0.08	-0.9, 0.08, 0.4
21	7.7	651.8	0.001,-0.6,-0.7	0.01,0.7,-0.6	0.9,-0.007,0.008
22	6.2	83.2	0.6, 0.3, 0.7	0.5, 0.42, -0.7	-0.6, 0.8, 0.05
23	7.5	151	0.02, 0.2, 0.9	-0.2, 0.9, -0.2	-0.9, -0.2, 0.07
24	10	65.3	0.4, 0.5, 0.8	-0.5, -0.5, 0.6	0.7, -0.6, 0.05
25	24.9	360.9	0.2, 0.6, 0.8	-0.2, 0.8, -0.5	-0.9, -0.008, 0.3
26	2.7	24.3	0.4, 0.5, 0.7	0.2, 0.7, -0.6	-0.9, 0.4, 0.2
27	3.2	64	0.3, -0.2, -0.9	0.2, 0.9, -0.1	0.9, -0.2, 0.3
28	254	560.5	0.05, -0.2, 0.9	0.08, 0.9, 0.2	-0.9, 0.07, 0.06
29	11.1	85.5	0.6, -0.2, -0.7	0.5, 0.8, 0.2	0.5, -0.5, 0.6
30	5.5	27.5	0.2, -0.08, 0.9	0.6, 0.7, -0.09	-0.7, 0.7, 0.2
31	35.5	6599.8	0.2, -0.3 -0.9	0.6, 0.8, -0.2	0.8, -0.5, 0.3
32	7.2	160.9	0.4, -0.4, 0.8	0.6, 0.8, 0.08	-0.7, 0.5, 0.5
33	8.1	57.5	0.6, 0.3, -0.7	0.2, 0.8, 0.5	0.8, -0.4, 0.4
34	8.2	84.6	0.2, -0.2, 0.9	0.3, 0.9, 0.1	-0.9, 0.3, 0.2
35	7.8	58.9	0.3, 0.6, -0.7	-0.8, 0.5, 0.1	0.5, 0.5, 0.6
36	56.7	613.9	0.02, -0.003,-0.9	-0.6, 0.8, -0.01	0.8, 0.6, 0.02
37	7.8	107	0.004, -0.7, -0.7	0.3, -0.67, 0.66	-0.9, -0.2, 0.2
38	4.6	22.5	0.6, -0.1, -0.8	0.1, 0.9, -0.02	0.8, -0.08, 0.6
39	1.5	93.5	0.4, -0.1, -0.9	-0.3, 0.9, -0.2	0.9, 0.3, 0.3
40	65.6	427.4	0.07, 0.19, -0.9	-0.4, 0.9, 0.15	0.9, 0.4, 0.14
41	9.1	136.5	0.05, 0.6, 0.8	-0.2, -0.8, 0.6	0.9, -0.2, 0.06
42	5.1	132.6	0.2, -0.19, 0.9	-0.2, 0.9, 0.22	-0.9, -0.2, 0.12
43	38.6	326.5	0.5, 0.008, 0.9	0.15, 0.9, -0.09	-0.9, 0.17, 0.5
44	27.1	129.8	0.3, -0.4, -0.9	0.2, 0.9, -0.3	0.9, -0.1, 0.3
45	4.8	30.8	0.1, -0.4, -0.9	0.68, 0.66, -0.2	0.7, -0.5, 0.4

Table 4. The Minimum Variance Analysis Results For Class I (2)

#	$\frac{\lambda_M}{\lambda_N}$	$\frac{\lambda_L}{\lambda_N}$	L	M	N
46	24.2	143.7	0.48, 0.27, 0.8	-0.29, 0.9, -0.1	-0.8, -0.17, 0.5
47	9.9	84.5	0.48, 0.41, 0.8	0.21, 0.79, -0.5	-0.84, 0.4, 0.3
48	2	7.1	0.38, 0.2, -0.9	0.4, 0.8, 0.4	0.8, -0.5, 0.2
49	10.6	41.3	0.16, 0.2, 0.9	-0.02, 0.9, -0.1	-0.9, 0.003, 0.17
50	7.5	92.3	0.2, -0.7, 0.67	0.5, 0.7, 0.5	-0.8, 0.2, 0.5
51	38.4	455.8	0.1, -0.5, 0.8	0.6, -0.6, -0.4	0.8, 0.6, 0.2
52	4	58.2	0.3, -0.2, -0.9	0.67, 0.7, 0.06	0.65, -0.63, 0.4
53	3.3	254.5	0.06, -0.07, -0.9	0.9, 0.4, 0.03	0.4, -0.9, 0.09
54	1.6	5.7	0.3, -0.65, 0.68	0.6, -0.4, -0.66	0.7, 0.6, 0.3
55	71.1	249.8	0.3, 0.3, -0.9	0.2, 0.9, 0.4	0.9, -0.3, 0.2
56	11.7	18.2	0.2 , 0.2, 0.9	-0.6, 0.8, -0.04	-0.8, -0.6, 0.2
57	6.5	52.9	0.1, -0.1, 0.9	0.9, -0.4, -0.2	0.4, 0.9, 0.1
58	15.3	22.7	0.2, -0.6, -0.7	-0.07, 0.74, -0.6	0.9, 0.2, 0.09
59	18.3	1023	0.3, 0.5, 0.8	0.09, 0.8, -0.5	-0.9, 0.2, 0.2
60	9.7	123.6	0.05, -0.2, 0.9	0.1, 0.9, 0.2	-0.9, 0.1, 0.07
61	42.3	999.1	0.3, 0.03, -0.9	0.2, 0.9, 0.08	0.9, -0.2, 0.3
62	15.2	161.1	0.5, 0.09, 0.9	-0.2, 0.9, 0.02	-0.9, -0.2, 0.5
63	8.6	1151.1	0.1, -0.002, 0.9	-0.3, 0.9, 0.04	-0.9, -0.3, 0.1
64	10.6	517.7	0.3, -0.034, 0.9	-0.7, 0.67, 0.2	-0.66, -0.73, 0.1
65	7.5	207.6	0.63, -0.4, 0.7	0.09, 0.9, 0.4	-0.8, -0.2, 0.6
66	6.9	62.6	0.2, -0.58, -0.8	0.57, 0.7, -0.4	0.8, -0.4, 0.5
67	8	190.4	0.06, 0.2, -0.9	-0.7, 0.6, 0.1	0.66, 0.70, 0.2
68	8.6	82.2	0.06, -0.09, 0.9	0.3, 0.9, 0.06	-0.9, 0.3, 0.08
69	5.9	38.3	0.2, 0.06, 0.9	0.3, 0.9, -0.1	-0.9, 0.3, 0.2
70	5.6	52.5	0.3, -0.4, 0.9	-0.2, 0.9, 0.5	-0.9, -0.3, 0.1
71	5.6	52.5	0.2, -0.4, 0.9	-0.3, 0.8, 0.5	-0.9, -0.4, 0.1
72	9.5	77.1	0.3, -0.6, 0.8	0.6, 0.7, 0.3	-0.7, 0.4, 0.6
73	14.3	163.4	0.3, 0.9, -0.3	-0.2, -0.3, -0.9	-0.94, 0.3, 0.06
74	1.6	10.2	0.004, 0.5, -0.9	-0.2, -0.9, -0.5	-0.9, 0.2, 0.1
75	52.2	410.9	0.5, 0.03, 0.9	-0.09, 0.9, 0.02	-0.9, -0.09, 0.5
76	4.9	19.7	0.1, -0.05, -0.9	0.8, 0.4, 0.09	0.5, -0.8, 0.1
77	104.4	384	0.43, -0.7, -0.6	0.7, -0.07, 0.6	-0.5, -0.7, 0.48
78	5	19.1	0.4, -0.2, 0.9	0.9, 0.04, -0.4	0.05, 0.9, 0.2
79	30.2	245.5	0.01, -0.430, 0.9	0.3, -0.85, -0.4	0.9, 0.27, 0.11
80	104.7	255.9	0.3, 0.05, -0.9	0.3, 0.9, 0.1	0.9, -0.3, 0.2
81	14.8	209.2	0.27, 0.3, -0.9	-0.7, 0.7, 0.03	0.7, 0.6, 0.4
82	3.2	16.2	0.4, -0.8, -0.3	0.26, -0.26, 0.9	-0.9, -0.5, 0.1
83	12.4	158	0.1, -0.3, 0.9	0.5, -0.8, -0.3	0.9, 0.5, 0.03
84	27.2	36	0.3, -0.9, 0.1	0.1, 0.2, 0.9	-0.9, -0.3, 0.2
85	2	56.7	0.04, -0.4, -0.9	0.2, 0.9, -0.4	0.9, -0.2, 0.1
86	6.1	76.2	0.1, -0.2, 0.9	0.008, 0.9, 0.2	-0.9, -0.01, 0.1
87	47.7	291	0.5, 0.2, -0.8	-0.03, 0.9, 0.2	0.8, -0.1, 0.5
88	2.7	25.9	0.4, -0.09, 0.9	-0.5, 0.8, 0.3	-0.8, -0.6, 0.2
89	43.8	212	0.05, 0.16, 0.9	-0.4, 0.9, -0.1	-0.9, -0.4, 0.1
90	8.4	218.5	0.08, 0.01, 0.9	-0.05, 0.9, -0.01	-0.9, -0.05, 0.08
91	12.9	122.4	0.2, 0.5, -0.8	-0.4, 0.8, 0.4	0.9, 0.2, 0.3
92	14.4	116.1	0.1, 0.1, 0.9	-0.2, 0.9, -0.1	-0.9, -0.2, 0.1
93	4.3	27.7	0.68, -0.3, 0.66	-0.1, 0.8, 0.57	-0.7, -0.5, 0.4
94	1.3	212.3	0.3, -0.5, 0.8	-0.3, 0.7, 0.6	-0.9, -0.5, 0.04
95	21.7	350.2	0.04, 0.009, 0.9	-0.3, 0.9, 0.005	-0.9, -0.3, 0.04
96	13.2	291.1	0.5, -0.06, 0.9	-0.2, 0.9, 0.2	-0.8, -0.3, 0.4
97	9.0	63.1	0.4, 0.2, -0.9	0.3, 0.9, 0.2	0.9, -0.4, 0.3
98	2	56.7	0.04, -0.4, -0.9	0.2, 0.8, -0.4	0.9, -0.2, 0.1

Table 5. The Minimum Variance Analysis Results For Class II

#	$\frac{\lambda_M}{\lambda_N}$	$\frac{\lambda_L}{\lambda_N}$	L	M	N
1	5.24	9.4	0.19,0.17,-0.96	-0.97,-0.04,-0.20	-0.07,0.98,0.15
2	2.7	24.3	0.4, 0.5,0.7	0.2, 0.7, -0.65	-0.8, 0.4, 0.2
3	4.7	856.8	0.21, 0.53, 0.81	-0.52, 0.77, -0.36	-0.82, -0.3, 0.4
4	8.8	11.9	0.48,-0.68,-0.54	-0.09,0.58,-0.80	0.87, 0.44, 0.22
5	33.6	18.7	0.14,-0.002,-0.98	-0.82,0.54,-0.12	0.54, 0.83,0.075
6	5.69	450.62	0.14,0.63,0.76	0.13,-0.78,0.62	0.98,0.01,-0.19
7	75.67	813.54	0.06,0.47,0.88	0.64,-0.70,0.33	0.77,0.54,-0.34
8	19.6	14218.5	0.08,0.72,0.69	0.60,-0.59,0.54	0.8,0.37,-0.48
9	42.25	103.88	0.01,0.59,0.81	0.61,-0.64,0.47	0.79,0.49,-0.36
10	29.62	186.86	0.6,-0.52,0.61	-0.20,-0.83,-0.52	0.78,0.19,-0.60
11	58.12	581.82	0.32,0.06,0.95	0.77,-0.61,-0.22	0.56,0.79,-0.24
12	10.1	11.9	0.05,0.86,-0.5	-0.1,-0.5,-0.8	-0.9,0.11, 0.07
13	10.1	11.9	0.05,0.86,-0.5	-0.1,-0.5,-0.8	-0.9,0.11, 0.07
14	3.3	30	0.4,-0.05,0.9	-0.16,0.97,0.12	-0.9,-0.2,0.38
15	1.8	18.1	0.01,0.34,-0.93	-0.85,0.5,0.17	0.5,0.8,0.3
16	1.8	9.9	0.01, 0.3, -0.9	-0.9, 0.5, 0.17	0.5, 0.8, 0.3
17	1.8	9.9	0.01, 0.3, -0.9	-0.9, 0.5, 0.17	0.5, 0.8, 0.3
18	8.2	21	0.15, 0.3, 0.9	-0.06, 0.9, -0.3	-0.9, -0.01, 0.2
19	8.2	21	0.15, 0.3, 0.9	-0.06, 0.9, -0.3	-0.9, -0.01, 0.2
20	8.2	21	0.15, 0.3, 0.9	-0.06, 0.9, -0.3	-0.9, -0.01, 0.2
21	6.3	136	0.2, -0.4, 0.9	0.4, 0.8, 0.3	-0.9, 0.3, 0.2
22	6.3	136	0.2, -0.4, 0.9	0.4, 0.8, 0.3	-0.9, 0.3, 0.2
23	6.3	136	0.2, -0.4, 0.9	0.4, 0.8, 0.3	-0.9, 0.3, 0.2
24	25.9	50	0.3, -0.42, 0.82	-0.17, 0.8, 0.5	-0.9, -0.32, 0.24
25	25.9	50	0.3, -0.42, 0.82	-0.17, 0.8, 0.5	-0.9, -0.32, 0.24
26	1.3	11.3	0.6, 0.2, -0.8	0.1, 0.9, 0.3	0.8, -0.2, 0.5
27	1.3	11.3	0.6, 0.2, -0.8	0.1, 0.9, 0.3	0.8, -0.2, 0.5
28	15.3	22.7	0.2, -0.6, -0.7	-0.08, 0.7, -0.6	0.9, 0.2, 0.09
29	20.5	62	0.4, 0.4, -0.8	0.3, 0.7, 0.6	0.8, -0.5, 0.1
30	62.4	596.8	0.2, 0.5, 0.8	-0.4, 0.8, -0.3	-0.9, -0.3, 0.4
31	62.4	596.8	0.2, 0.5, 0.8	-0.4, 0.8, -0.3	-0.9, -0.3, 0.4
32	254	560.5	0.05, -0.2, 0.9	0.08, 0.9, 0.17	-0.9, 0.07, 0.06
33	9.8	15.5	0.3, -0.4, 0.9	-0.4, 0.8, 0.4	-0.9, -0.5, 0.07
34	4.4	33.8	0.9, -0.4, -0.07	0.3, 0.8, -0.5	0.2, 0.4, 0.9

Table 6. The Timing analysis Results For Class I (1)

#	$[n_x, n_y, n_z]$	$[Vn_x, Vn_y, Vn_z]$	Vn
1	0.38 , -0.356 , -0.853	51.37 , -47.97 , -115.05	134.82
2	0.26 , -0.965 , 0.02	23.24 , -85.19 , 1.8	88.32
3	0.87 , -0.094 , 0.485	168.08 , -18.18 , 93.88	193.38
4	0.28 , -0.921 , -0.276	116.86 , -389.12 , -116.68	422.71
5	0.02 , -0.991 , 0.136	3.19 , -195.17 , 26.83	197.03
6	0.81 , -0.588 , 0.07	202.57 , -147.94 , 17.71	251.46
7	0.99 , 0.053 , -0.146	194.04 , 10.33 , -28.58	196.41
8	0.7 , -0.686 , 0.189	403.04 , -393.44 , 108.11	573.52
9	0.74 , -0.599 , -0.295	226.23 , -182.21 , -89.76	304.03
10	0.76 , -0.598 , -0.24	164.93 , -128.92 , -51.78	215.64
11	0.75 , -0.648 , -0.105	162.66 , -139.76 , -22.75	215.66
12	0.51 , 0.811 , -0.29	96.6 , 153.86 , -54.98	189.8
13	0.82 , 0.531 , -0.215	179.13 , 115.95 , -46.9	218.47
14	0.89 , -0.206 , -0.406	243.52 , -56.35 , -110.9	273.46
15	0.97 , 0.225 , 0.072	123.52 , 28.55 , 9.09	127.11
16	0.8 , 0.39 , 0.449	203.21 , 98.62 , 113.57	252.82
17	0.91 , -0.25 , -0.339	239.78 , -66.08 , -89.69	264.4
18	0.7 , 0.266 , -0.663	188.72 , 71.68 , -179.0	269.81
19	0.42 , 0.594 , -0.688	4.32 , 6.17 , -7.14	10.38
20	0.95 , -0.236 , -0.198	255.1 , -63.26 , -53.14	268.15
21	0.99 , -0.063 , 0.15	175.52 , -11.21 , 26.69	177.89
22	0.94 , -0.279 , -0.174	213.39 , -63.06 , -39.39	225.97
23	0.88 , 0.194 , 0.432	115.01 , 25.29 , 56.37	130.56
24	0.64 , -0.486 , 0.598	82.99 , -63.38 , 77.99	130.33
25	0.95 , -0.319 , -0.047	217.83 , -73.47 , -10.84	230.14
26	0.88 , 0.419 , -0.223	329.59 , 157.1 , -83.44	374.53
27	0.72 , -0.696 , 0.024	313.59 , -303.95 , 10.28	436.84
28	0.79 , 0.543 , -0.285	143.39 , 98.48 , -51.78	181.49
29	0.26 , -0.965 , 0.02	23.24 , -85.19 , 1.8	88.32
30	0.95 , -0.27 , 0.161	154.92 , -44.14 , 26.2	163.2
31	0.53 , -0.717 , 0.454	101.19 , -137.26 , 86.85	191.37
32	0.86 , -0.05 , -0.516	300.88 , -17.57 , -181.32	351.73
33	0.87 , -0.411 , -0.274	292.12 , -138.17 , -92.21	336.05
34	0.95 , -0.006 , -0.319	174.46 , -1.11 , -58.73	184.09
35	0.39 , 0.679 , 0.624	131.99 , 232.17 , 213.2	341.73
36	0.87 , -0.389 , 0.289	88.3 , -39.32 , 29.22	100.98
37	0.71 , 0.485 , -0.511	148.3 , 101.41 , -106.83	209.02
38	0.63 , -0.187 , 0.753	118.33 , -35.15 , 141.35	187.66
39	0.97 , -0.141 , 0.18	355.57 , -51.43 , 65.87	365.26
40	0.99 , 0.156 , 0.07	161.33 , 25.62 , 11.39	163.75
41	0.99 , -0.034 , 0.156	239.21 , -8.2 , 37.91	242.34
42	0.97 , 0.235 , 0.097	348.86 , 84.89 , 34.86	360.73
43	0.8 , -0.254 , -0.537	204.48 , -64.54 , -136.54	254.21
44	0.73 , -0.37 , 0.571	84.13 , -42.42 , 65.58	114.8
45	0.74 , -0.649 , -0.168	296.82 , -259.81 , -67.26	400.16

Table 7. The Timing analysis Results For Class I (2)

#	$[n_x, n_y, n_z]$	$[Vn_x, Vn_y, Vn_z]$	Vn
46	0.94 , -0.273 , 0.183	568.21 , -163.99 , 110.15	601.57
47	0.97 , -0.145 , -0.211	228.18 , -34.34 , -49.73	236.04
48	0.84 , -0.528 , -0.093	357.72 , -223.96 , -39.39	423.88
49	0.86 , 0.192 , -0.476	121.7 , 27.25 , -67.43	141.78
50	0.95 , -0.299 , -0.114	235.95 , -74.48 , -28.39	249.05
51	0.87 , 0.466 , 0.162	307.73 , 164.84 , 57.43	353.79
52	0.94 , -0.273 , -0.181	38.78 , -11.21 , -7.41	41.04
53	0.94 , -0.277 , -0.18	38.3 , -11.25 , -7.31	40.58
54	0.84 , -0.382 , 0.394	467.4 , -213.7 , 220.36	559.19
55	0.9 , -0.431 , -0.05	207.77 , -99.35 , -11.48	230.59
56	0.7 , 0.669 , -0.259	220.02 , 211.09 , -81.8	315.69
57	0.54 , 0.839 , -0.056	55.35 , 85.74 , -5.77	102.22
58	0.82 , -0.474 , 0.33	206.66 , -120.12 , 83.65	253.25
59	0.73 , -0.678 , 0.042	399.29 , -369.06 , 22.65	544.2
60	0.98 , -0.19 , -0.061	341.74 , -66.41 , -21.31	348.78
61	0.87 , -0.377 , 0.328	112.58 , -48.95 , 42.63	129.95
62	0.94 , -0.251 , -0.222	130.45 , -34.82 , -30.74	138.47
63	0.99 , 0.118 , 0.002	220.9 , 26.24 , 0.53	222.46
64	0.81 , 0.543 , -0.209	106.76 , 71.31 , -27.48	131.3
65	0.72 , 0.046 , -0.694	112.96 , 7.17 , -109.14	157.23
66	0.78 , 0.353 , 0.516	325.87 , 147.51 , 215.65	417.68
67	0.21 , 0.949 , -0.24	63.88 , 293.0 , -74.07	308.89
68	0.96 , -0.167 , -0.244	430.04 , -75.22 , -109.97	450.21
69	0.94 , -0.155 , -0.306	170.69 , -28.09 , -55.54	181.68
70	0.97 , 0.199 , -0.155	298.65 , 61.58 , -47.84	308.66
71	0.93 , -0.153 , -0.329	232.98 , -38.32 , -82.13	249.99
72	0.93 , -0.153 , -0.329	232.98 , -38.32 , -82.13	249.99
73	0.68 , -0.574 , 0.463	136.57 , -116.07 , 93.74	202.26
74	0.99 , 0.061 , -0.16	218.33 , 13.5 , -35.37	221.59
75	0.7 , 0.266 , -0.663	188.72 , 71.68 , -179.0	269.81
76	0.42, 0.594 , -0.688	4.32 , 6.17 , -7.14	10.38
77	0.3 , 0.804 , -0.511	59.35 , 157.6 , -100.15	195.94
78	0.85, -0.366 , 0.389	24.77 , -10.73 , 11.4	29.3
79	0.92 , -0.321 , -0.229	132.51 , -46.36 , -32.99	144.21
80	0.93 , -0.372 , 0.053	223.73 , -89.93 , 12.75	241.46
81	0.8 , 0.587 , 0.113	84.0 , 61.46 , 11.84	104.76
82	0.83 , 0.383 , -0.409	312.34 , 144.4 , -154.03	377.01
83	0.9 , 0.405 , 0.162	88.23 , 39.71 , 15.87	98.05
84	0.8 , 0.496 , -0.34	158.42 , 98.38 , -67.41	198.29
85	0.79 , -0.531 , 0.318	241.56 , -163.46 , 97.84	307.64
86	0.9 , 0.392 , -0.206	507.08 , 221.45 , -116.44	565.44
87	0.96, -0.291, 0.007	33.28, -10.13, 0.23	426.45
88	0.96,0.245,-0.142	357.51,91.52, -53.0	372.83
89	0.86 , 0.466 , -0.228	145.45 , 79.19 , -38.84	170.1
90	0.92 , -0.394 , 0.056	144.5 , -62.07 , 8.81	157.52
91	0.96 , 0.212 , 0.169	290.26 , 63.81 , 50.99	301.53
92	0.98 , 0.173 , -0.094	257.14 , 45.3 , -24.62	262.26
93	0.75 , -0.103 , -0.659	343.13 , -47.58 , -303.45	460.52
94	0.71 , 0.583 , 0.389	123.38 , 100.8 , 67.37	172.98
95	0.87 , 0.475 , 0.102	223.45 , 121.5 , 25.97	255.67
96	0.87 , 0.396 , -0.298	161.21 , 73.57 , -55.35	185.65
97	0.74 , -0.554 , 0.376	258.03 , -192.22 , 130.36	347.16
98	0.67 , 0.361 , -0.648	353.67 , 190.59 , -341.67	527.39

Table 8. The Timing analysis Results For Class II

#	$[n_x, n_y, n_z]$	$[Vn_x, Vn_y, Vn_z]$	Vn
1	0.73,0.669,0.144	123.0,112.86,24.36	168.71
2	0.97,-0.238,0.097	222.49,-54.7,22.25	230.19
3	0.14,-0.986,0.087	27.27,-192.72,16.91	195.37
4	0.95,0.22,-0.228	532.67,123.57,-128.22	561.65
5	0.86,0.302,0.416	537.49,189.28,260.74	626.67
6	0.95,0.30,-0.09	186,59,-18	196
7	0.95,0.27,-0.13	129,36,-17	135
8	0.86,0.17,-0.48	241,49,-135	281
9	0.60,0.72,-0.35	289,345, -169	481
10	0.34, 0.30,-0.89	124, 111, -327	367
11	0.54, 0.83,-0.14	251, 390, -63	468
12	0.83, -0.56 , -0.02	23.83 , -16.07 , -0.44	331.11
13	0.83,-0.56 , -0.02	23.83 , -16.07, -0.44	331.11
14	0.85 , -0.24 , 0.47	27.32 , -7.73 , 15.1	246.74
15	0.69 , -0.7 , -0.15	7.32 , -7.45 , -1.63	41.95
16	0.62 , -0.65 , -0.44	26.98 , -28.48,-19.33	164.03
17	0.47 , -0.87 , -0.17	14.56 , -26.94 , -5.36	36.72
18	0.951 , -0.167 , 0.261	5.42 , -0.95 , 1.49	451.28
19	0.951 , -0.167 , 0.261	5.42 , -0.95 , 1.49	451.28
20	0.951 , -0.167 , 0.261	5.42 , -0.95 , 1.49	451.28
21	0.94, 0.35 , 0.01	34.57 , 13.1 , 0.06	298.36
22	0.86, -0.27 , -0.44	22.66 , -7.18 , -11.64	273.7
23	0.86, -0.27 , -0.44	22.66 , -7.18 , -11.64	273.7
24	0.91, -0.39 , -0.11	6.98 , -3.02 , -0.84	195.27
25	0.91, -0.39 , -0.11	6.98 , -3.02 , -0.84	195.27
26	0.84, -0.53 , -0.13	21.52 , -13.74,-3.37	135.05
27	0.84, -0.53 , -0.13	21.52 , -13.74 , -3.37	135.05
28	0.86, 0.302 , 0.416	537.49 , 189.28 , 260.74	627
29	0.98, 0.002 , 0.197	142.15 , 0.26 , 28.63	145.01
30	0.72, 0.301 , 0.623	320.71 , 133.82 , 277.01	444
31	0.72, 0.301 , 0.623	320.71 , 133.82 , 277.01	444
32	0.935, 0.354 , 0.001	34.57 , 13.1 , 0.06	302.41
33	0.645, 0.062 , 0.762	14.84 , 1.43 , 17.52	199.46
34	0.85,0.308,-0.433	450.81 , 164.17 , -230.5	532.27