A Universal Optimal Sizing for Hybrid Energy Storage System of Electric Vehicles
Appendix: Sizing result

1. Full-active configuration

No.	n_{bat_s}	n_{bat_p}	n_{sc_s}	n_{sc_p}	RMS_{cell} [A]	$Cost$ [USD]	HESS mass [kg]	HESS volume [m^3]
1	58	57	64	1	0.774940	10846.2	250.2931	0.089988
2	65	51	61	1	0.774944	10780.5	250.6812	0.089984
3	62	54	50	1	0.776662	10539.6	252.1042	0.089969
4	62	53	50	1	0.789403	10372.2	247.5211	0.088376
5	60	54	50	1	0.798688	10248	244.1208	0.087193
6	60	53	55	1	0.807297	10236	240.1476	0.086043
7	57	55	54	1	0.817767	10084.5	236.7288	0.084808
8	70	45	50	1	0.818533	10005	237.4680	0.084880
9	61	51	49	1	0.827325	9869.7	234.4927	0.083800
10	60	51	50	1	0.838461	9762	230.8152	0.082567
11	57	53	49	1	0.848875	9626.7	227.8399	0.081486
12	62	48	49	1	0.859616	9505.2	224.5135	0.080330
13	61	48	49	1	0.871578	9375.6	220.9654	0.079096
14	59	49	49	1	0.881659	9275.7	218.2303	0.078145
15	74	38	53	1	0.899346	9182.4	212.7602	0.076429
16	60	47	48	1	0.901514	9054	212.8896	0.076242
17	59	47	48	1	0.915672	8927.1	209.4154	0.075034
18	62	44	48	1	0.928598	8805.6	206.0890	0.073878
19	61	44	48	1	0.941498	8686.8	202.8365	0.072747
20	56	47	48	1	0.957745	8546.4	198.9926	0.071410
21	58	45	48	1	0.965818	8487	197.3664	0.070845
22	56	46	47	1	0.977137	8365.2	194.7607	0.069892
23	62	41	47	1	0.989206	8273.4	192.2474	0.069019
24	64	39	47	1	1.004947	8149.2	188.8471	0.067836
25	56	44	47	1	1.016729	8062.8	186.4817	0.067014
26	60	40	47	1	1.041262	7890	181.7508	0.065369
27	67	35	51	1	1.058261	7861.5	178.0548	0.064269
28	66	35	51	1	1.072955	7767	175.4676	0.063370
29	57	40	51	1	1.085713	7686	173.2500	0.062599
30	61	37	51	1	1.095408	7623.9	171.5498	0.062007
31	61	37	46	1	1.101325	7473.9	171.0878	0.061615
32	62	35	53	1	1.133233	7449	165.3036	0.059928
33	58	37	53	1	1.144468	7384.2	163.5295	0.059312
34	56	37	58	1	1.175207	7334.4	158.5214	0.057802
35	57	36	57	1	1.186308	7250.4	156.9506	0.057209
36	63	32	60	1	1.202326	7243.2	154.5667	0.056519
37	60	33	58	1	1.225187	7086	151.7208	0.055437
38	60	33	50	1	1.233167	6846	150.9816	0.054810
39	64	31	45	1	1.237042	6706.8	150.8153	0.054520
40	56	35	45	1	1.252189	6642	149.0412	0.053904

2. Semi-active configuration

No.	n_{bat_s}	n_{bat_p}	n_{sc_s}	n_{sc_p}	RMS_{cell} [A]	$Cost$ [USD]	HESS mass [kg]	HESS volume [m^3]
1	91	40	62	1	0.697780	11688	231.97	0.093280
2	91	40	56	1	0.701709	11508	231.50	0.092834
3	91	40	52	1	0.704308	11388	231.19	0.092537
4	91	38	54	1	0.734383	10956.6	219.99	0.088252
5	91	37	58	1	0.748922	10830.9	214.62	0.086333
6	91	37	55	1	0.750770	10740.9	214.39	0.086110
7	91	36	58	1	0.766907	10585.2	208.95	0.084116
8	91	36	53	1	0.770380	10435.2	208.56	0.083744
9	91	35	58	1	0.786967	10339.5	203.27	0.081899
10	91	35	51	1	0.790950	10129.5	202.72	0.081379
11	91	34	53	1	0.810505	9943.8	197.20	0.079311
12	91	34	51	1	0.812211	9883.8	197.04	0.079162
13	91	33	57	1	0.829496	9818.1	191.83	0.077391
14	91	33	54	1	0.831246	9728.1	191.60	0.077168
15	91	32	58	1	0.851431	9602.4	186.23	0.075249
16	91	32	52	1	0.855863	9422.4	185.76	0.074803
17	91	31	56	1	0.877083	9296.7	180.40	0.072883
18	91	31	53	1	0.879338	9206.7	180.16	0.072660
19	91	30	57	1	0.902023	9081	174.80	0.070741
20	91	30	53	1	0.905259	8961	174.49	0.070443
21	91	29	55	1	0.931423	8775.3	168.96	0.068375
22	91	28	62	1	0.956015	8739.6	163.83	0.066679
23	91	28	60	1	0.957952	8679.6	163.68	0.066530
24	91	28	53	1	0.964262	8469.6	163.13	0.066010
25	91	27	61	1	0.988579	8463.9	158.07	0.064388
26	91	27	59	1	0.990392	8403.9	157.92	0.064239
27	91	26	66	1	1.018069	8368.2	152.79	0.062543
28	91	26	53	1	1.030630	7978.2	151.77	0.061576
29	91	25	60	1	1.060490	7942.5	146.64	0.059880
30	91	25	55	1	1.065593	7792.5	146.25	0.059508
31	91	24	61	1	1.101345	7726.8	141.04	0.057737
32	91	24	57	1	1.103889	7606.8	140.73	0.057440
33	91	24	51	1	1.110066	7426.8	140.26	0.056994
34	91	24	50	1	1.111230	7396.8	140.18	0.056920
35	91	23	56	1	1.148763	7331.1	134.97	0.055149
36	91	23	53	1	1.152083	7241.1	134.74	0.054926
37	91	23	48	1	1.157319	7091.1	134.35	0.054554
38	91	22	56	1	1.197918	7085.4	129.29	0.052932
39	91	22	55	1	1.199126	7055.4	129.21	0.052858
40	91	22	47	1	1.206593	6815.4	128.59	0.052263

3. Passive configuration

No.	n_{bat_s}	n_{bat_p}	n_{sc_s}	n_{sc_p}	RMS_{cell} [A]	$Cost$ [USD]	HESS mass [kg]	HESS volume [m^3]
1	91	38	135	1	0.779428	13386.6	200.197	0.089084
2	91	37	135	1	0.798493	13140.9	195.173	0.086989
3	91	36	135	1	0.817619	12895.2	190.150	0.084894
4	91	35	135	1	0.838859	12649.5	185.127	0.082800
5	91	34	135	1	0.860289	12403.8	180.104	0.080705
6	91	33	135	1	0.884105	12158.1	175.081	0.078610
7	91	32	135	1	0.908287	11912.4	170.057	0.076515
8	91	31	135	1	0.935184	11666.7	165.034	0.074420
9	91	30	135	1	0.962676	11421	160.011	0.072326
10	91	29	135	1	0.992058	11175.3	154.988	0.070231
11	91	28	135	1	1.024807	10929.6	149.965	0.068136
12	91	27	135	1	1.058648	10683.9	144.941	0.066041
13	91	26	135	1	1.096462	10438.2	139.918	0.063947
14	91	25	135	1	1.135863	10192.5	134.895	0.061852
15	91	24	135	1	1.180018	9946.8	129.872	0.059757
16	91	23	135	1	1.226452	9701.1	124.849	0.057662
17	91	22	135	1	1.278711	9455.4	119.825	0.055568
18	91	21	135	1	1.334219	9209.7	114.802	0.053473

With:

- n_{bat_s}: number of battery cells connected in series
- n_{bat_p}: number of battey branches connected in parallel
- n_{sc_s}: number of supercapacitor modules connected in series
- n_{sc_p}: number of supercapacitor branches connected in parallel
- RMS_{cell}: root-mean-squate value of the battery cell current
- $Cost$: the price of the energy storage system