

Table 1: Comparison of our 3-stage method and QSM w.r.t. solutions times, and # PRO RE solutions.

instance	time [s]		$ Y_{\text{eff}}^{\psi} $		$ Y_{\text{FRE}}^{\text{PRO}} $		$ Y_{\text{r-light}}^{\text{PRO}}(Y_{\text{eff}}^{\text{PRO}}(\hat{q}), \varepsilon, \kappa) $		$ Y_{\text{HRE}}^{\text{PRO}} $	
	QSM	3-stage	QSM	3-stage	QSM	3-stage	QSM	3-stage	QSM	3-stage
1	20000	9584	13	12	11	11	1	1	0	0
2	17443	4335	18	11	10	10	2	2	0	0
3	7235	4172	5	5	5	5	0	0	3	3
4	20000	5224	11	11	11	11	4	4	0	0
5	18650	5532	14	8	8	8	3	3	1	1
6	17078	10602	11	10	9	9	1	1	2	2
7	14210	15302	8	8	8	8	2	2	5	5
8	9703	7856	5	5	5	5	0	0	5	5
9	12964	8807	6	6	6	6	0	0	6	6
10	20000	5655	15	11	11	11	4	4	1	1
11	20000	18328	10	12	11	11	2	2	2	2
12	7624	8081	7	7	7	7	0	0	5	5
13	14620	5855	10	9	9	9	3	3	2	2
14	16147	8470	10	10	10	10	0	0	3	3
15	16337	6138	8	8	8	8	3	3	1	1
16	20000	5733	12	11	11	11	2	2	0	0
17	12741	4422	9	9	8	8	1	1	2	2
18	19648	4138	18	10	10	10	4	4	0	0
19	10714	7771	5	5	5	5	0	0	0	0
20	16308	6874	8	8	8	8	3	3	2	2
21	10389	5067	8	8	8	8	1	1	2	2
22	17420	11217	8	8	8	8	3	3	2	2
23	14033	9312	9	9	9	9	1	1	4	4
24	13759	8505	7	7	7	7	0	0	4	4
25	5962	5897	6	6	6	6	0	0	5	5
26	10222	4451	9	8	8	8	3	3	2	2
27	13766	5343	10	8	8	8	3	3	2	2
28	6873	5861	8	7	7	7	0	0	5	5
29	7453	4930	7	7	7	7	2	2	3	3
30	8405	3495	9	9	9	9	3	3	1	1