Supplementary materials

The geometric parameter values and motion amplitudes for the optimal geometries, shown in figures 5 and 6 of the main document, are tabulated here. Each table below gives information for a particular group, for the heave-only (denoted 'heave') and the heave-surge-pitch (denoted 'h-s-p') optimisations, for $\alpha_0 = 3$ and 1 and $\epsilon_0 = 0.1$ and 0.2, totalling 8 optimisations for each group.

In the tables, each row describes the properties of the optimal shape for one of the 8 optimisations. As in the main paper, nondimensional l_S is wavenumber k^* times square-root of wetted surface area, $l_S^* = (S_W^*)^{1/2}$. l_V is k^* times cube-root of submerged volume, $l_V^* = (V^*)^{1/3}$. Then, the relevant geometric parameters for the optimised geometries are listed (for definitions, see §4.1). For a description of each group, see §4.4. And finally, the motion amplitudes are listed (for the definition, see §3).

	α_0	ϵ_0	l_S	l_V	R	H	α_1	α_3	α_5
heave	3	0.1	1.87	0.89	0.57	0.68		3.0	
heave	3	0.2	1.87	0.89	0.57	0.68		3.0	
heave	1	0.1	2.58	1.19	1.04	0.49		1.0	
heave	1	0.2	2.58	1.19	1.04	0.49		1.0	
h-s-p	3	0.1	2.86	1.26	1.26	0.4	0.66	0.7	2.41
h-s-p	3	0.2	3.03	1.3	1.38	0.37	0.67	0.6	1.69
h-s-p	1	0.1	3.31	1.28	1.64	0.25	0.81	0.42	0.96
h-s-p	1	0.2	3.31	1.28	1.64	0.25	0.81	0.42	0.96

Table 1: Dimensions and characteristics of the optimal **cylinder** shapes

1

	α_0	ϵ_0	l_S	l_V	R	H	r_1	α_1	α_3	α_5
heave	3	0.1	1.17	0.51	0.32	0.29		1.39	3.0	
heave	3	0.2	1.59	0.72	0.49	0.4		1.21	2.0	
heave	1	0.1	1.79	0.59	0.63	0.12		1.31	1.0	
heave	1	0.2	1.93	0.75	0.71	0.22		1.23	0.98	
h-s-p	3	0.1	2.4	0.84	0.98	0.16	1.17	2.11	0.63	1.44
h-s-p	3	0.2	2.94	1.1	1.35	0.22	1.07	1.15	0.48	1.05
h-s-p	1	0.1	3.14	1.2	1.51	0.24	1.03	0.94	0.45	0.98
h-s-p	1	0.2	3.14	1.2	1.51	0.24	1.03	0.94	0.45	0.98

Table 2: Dimensions and characteristics of the optimal **flat-bottomed** shapes

	α_0	ϵ_0	l_S	l_V	R	H	r_1	z_1	α_1	α_3	α_5
heave	3	0.1	0.98	0.41	0.25	0.32	1.65	-0.2		3.01	
heave	3	0.2	1.14	0.53	0.28	0.6	1.5	-0.25		3.02	
heave	1	0.1	1.7	0.45	0.56	0.13	1.4	-0.1		1.02	
heave	1	0.2	1.99	0.89	0.73	0.49	1.2	-0.5		1.0	
h-s-p	3	0.1	2.4	0.84	0.98	0.16	1.17	-1.0	2.11	0.63	1.44
h-s-p	3	0.2	2.73	1.05	1.21	0.28	1.1	-0.7	1.32	0.53	1.16
h-s-p	1	0.1	3.09	1.25	1.47	0.41	1.05	-0.5	0.96	0.44	0.93
h-s-p	1	0.2	3.09	1.25	1.47	0.41	1.05	-0.5	0.96	0.44	0.93

Table 3: Dimensions and characteristics of the optimal **one-kink** shapes

	α_0	ϵ_0	l_S	l_V	R	H	a_{12}	b_{12}	α_1	α_3	α_5
heave	3	0.1	1.13	0.5	0.31	0.27	-0.45	0.1		2.71	
heave	3	0.2	1.25	0.6	0.33	0.57	-0.4	-0.05		2.83	
heave	1	0.1	1.77	0.53	0.59	0.14	-0.4	-0.1		0.98	
heave	1	0.2	1.88	0.78	0.65	0.34	-0.35	0.0		1.02	
h-s-p	3	0.1	2.62	1.25	1.13	0.57	-0.2	0.1	0.72	0.69	1.99
h-s-p	3	0.2	2.59	1.2	1.15	0.44	-0.2	0.15	0.83	0.66	1.71
h-s-p	1	0.1	3.02	1.25	1.43	0.29	-0.2	0.2	0.94	0.46	0.98
h-s-p	1	0.2	3.02	1.25	1.43	0.29	-0.2	0.2	0.94	0.46	0.98

Table 4: Dimensions and characteristics of the optimal **no-kink-2nd-order** shapes

	α_0	ϵ_0	l_S	l_V	R	H	z_1	α_1	α_3	α_5
heave	3	0.1	1.87	0.89	0.57	0.71	-0.95		3.0	
heave	3	0.2	1.87	0.89	0.57	0.71	-0.95		3.0	
heave	1	0.1	2.54	1.21	1.03	0.64	-0.75		1.01	
heave	1	0.2	2.54	1.21	1.03	0.64	-0.75		1.01	
h-s-p	3	0.1	2.86	1.26	1.26	0.4	-1.0	0.66	0.7	2.41
h-s-p	3	0.2	3.03	1.3	1.38	0.37	-1.0	0.67	0.6	1.69
h-s-p	1	0.1	3.31	1.28	1.64	0.25	-1.0	0.81	0.42	0.96
h-s-p	1	0.2	3.31	1.28	1.64	0.25	-1.0	0.81	0.42	0.96

Table 5: Dimensions and characteristics of the optimal **wall-sided** shapes

	α_0	ϵ_0	l_S	l_V	R	H	r_2	z_2	α_1	α_3	α_5
heave	3	0.1	1.24	0.48	0.31	0.3	1.4	-0.8		3.0	
heave	3	0.2	1.6	0.69	0.44	0.49	1.2	-0.85		2.47	
heave	1	0.1	2.28	0.96	0.85	0.36	1.1	-0.5		1.0	
heave	1	0.2	2.28	0.96	0.85	0.36	1.1	-0.5		1.0	
h-s-p	3	0.1	2.77	1.0	1.16	0.22	1.1	-0.55	1.36	0.58	1.34
h-s-p	3	0.2	3.03	1.3	1.38	0.37	1.0	-1.0	0.67	0.6	1.69
h-s-p	1	0.1	3.31	1.28	1.64	0.25	1.0	-1.0	0.81	0.42	0.96
h-s-p	1	0.2	3.31	1.28	1.64	0.25	1.0	-1.0	0.81	0.42	0.96

Table 6: Dimensions and characteristics of the optimal **compound cylinder** shapes