

The training data of multi-objective genetic algorithm

Note that in the following tables, U denotes average currently in inlet and outlet zone, u^* denotes friction velocity, Re denotes the Reynolds number, F_r denotes the Froude number, Re^* denotes the friction Reynolds number and u_g^* denotes the dimensionless ghost particle velocity in wall function model.

Table 1 Training data for the case of hydraulic smooth flow.

Case		U (m/s)	u^* (m/s)	Re	F_r	Re^*	u_g^* (m/s)
1	H50s001ks0.05(2)	0.446	0.02215	22300	0.636818	1.107362	0.2
2	H50s001ks0.05(3)	0.446	0.02215	22300	0.636818	1.107362	0.23
3	H50s001ks0.05(4)	0.446	0.02215	22300	0.636818	1.107362	0.24
4	H50s002ks0.05(2)	0.73	0.03132	36500	1.042325	1.566046	0.35
5	H50s002ks0.05(3)	0.73	0.03132	36500	1.042325	1.566046	0.38
6	H50s002ks0.05(4)	0.73	0.03132	36500	1.042325	1.566046	0.45
7	H50s004ks0.05(2)	1.2	0.04429	60000	1.713412	2.214723	0.47
8	H50s004ks0.05(3)	1.2	0.04429	60000	1.713412	2.214723	0.5
9	H50s004ks0.05(4)	1.2	0.04429	60000	1.713412	2.214723	0.55
10	H80s001ks0.05(2)	0.631	0.02801	50480	0.712279	1.400714	0.31
11	H80s001ks0.05(3)	0.631	0.02801	50480	0.712279	1.400714	0.33
12	H80s001ks0.05(4)	0.631	0.02801	50480	0.712279	1.400714	0.35
13	H80s002ks0.05(2)	1.05	0.03962	84000	1.18525	1.980909	0.51
14	H80s002ks0.05(3)	1.05	0.03962	84000	1.18525	1.980909	0.55
15	H80s002ks0.05(4)	1.05	0.03962	84000	1.18525	1.980909	0.6
16	H80s004ks0.05(2)	1.58	0.05603	126400	1.783518	2.801428	0.7
17	H80s004ks0.05(3)	1.58	0.05603	126400	1.783518	2.801428	0.75
18	H80s004ks0.05(4)	1.58	0.05603	126400	1.783518	2.801428	0.8
19	H100s001ks0.05(2)	0.74	0.03132	74000	0.747132	1.566046	0.34
20	H100s001ks0.05(3)	0.74	0.03132	74000	0.747132	1.566046	0.36
21	H100s001ks0.05(4)	0.74	0.03132	74000	0.747132	1.566046	0.4
22	H100s002ks0.05(2)	1.18	0.04429	118000	1.191372	2.214723	0.52
23	H100s002ks0.05(3)	1.18	0.04429	118000	1.191372	2.214723	0.55
24	H100s002ks0.05(4)	1.18	0.04429	118000	1.191372	2.214723	0.6
25	H100s004ks0.05(2)	1.86	0.06264	186000	1.877926	3.132092	0.95
26	H100s004ks0.05(3)	1.86	0.06264	186000	1.877926	3.132092	1
27	H100s004ks0.05(4)	1.86	0.06264	186000	1.877926	3.132092	1.1
28	H50s001ks0.1(2)	0.493	0.022147	24650	0.703927	2.214723	0.25
29	H50s001ks0.1(3)	0.493	0.022147	24650	0.703927	2.214723	0.27
30	H50s001ks0.1(4)	0.493	0.022147	24650	0.703927	2.214723	0.3
31	H50s001ks0.2(2)	0.54	0.022147	27000	0.771035	4.429447	0.29
32	H50s001ks0.2(3)	0.54	0.022147	27000	0.771035	4.429447	0.31
33	H50s001ks0.2(4)	0.54	0.022147	27000	0.771035	4.429447	0.34
34	H50s001ks0.15(2)	0.515	0.022147	25750	0.735339	3.322085	0.27

35	H50s001ks0.15(3)	0.515	0.022147	25750	0.735339	3.322085	0.29
36	H50s001ks0.15(4)	0.515	0.022147	25750	0.735339	3.322085	0.32
37	H50s002ks0.1(2)	0.785	0.031321	39250	1.120857	3.132092	0.39
38	H50s002ks0.1(3)	0.785	0.031321	39250	1.120857	3.132092	0.41
39	H50s002ks0.1(4)	0.785	0.031321	39250	1.120857	3.132092	0.44
40	H50s002ks0.15(2)	0.816	0.031321	40800	1.16512	4.698138	0.42
41	H50s002ks0.15(3)	0.816	0.031321	40800	1.16512	4.698138	0.44
42	H50s002ks0.15(4)	0.816	0.031321	40800	1.16512	4.698138	0.46
43	H50s003ks0.1(2)	0.988	0.03836	49400	1.410709	3.836014	0.49
44	H50s003ks0.1(3)	0.988	0.03836	49400	1.410709	3.836014	0.51
45	H50s003ks0.1(4)	0.988	0.03836	49400	1.410709	3.836014	0.55
46	H50s004ks0.1(2)	1.188	0.044294	59400	1.696278	4.429447	0.59
47	H50s004ks0.1(3)	1.188	0.044294	59400	1.696278	4.429447	0.61
48	H50s004ks0.1(4)	1.188	0.044294	59400	1.696278	4.429447	0.65
49	H50s005ks0.1(2)	1.233	0.049523	61650	1.760531	4.952272	0.67
50	H50s005ks0.1(3)	1.233	0.049523	61650	1.760531	4.952272	0.7
51	H50s005ks0.1(4)	1.233	0.049523	61650	1.760531	4.952272	0.75

Table 2 Training data for the case of hydraulic transition flow experimental group.

Case	U (m/s)	u^* (m/s)	Re	Fr	Re^*	u_g^* (m/s)	
1	H50s001ks1(2)	0.55	0.02215	27500	0.785314	22.14723	0.25
2	H50s001ks1(3)	0.55	0.02215	27500	0.785314	22.14723	0.27
3	H50s001ks1(4)	0.55	0.02215	27500	0.785314	22.14723	0.3
4	H50s001ks2(2)	0.545	0.02215	27250	0.778175	44.29447	0.24
5	H50s001ks2(3)	0.545	0.02215	27250	0.778175	44.29447	0.26
6	H50s001ks2(4)	0.545	0.02215	27250	0.778175	44.29447	0.28
7	H50s002ks1(2)	0.805	0.03132	40250	1.149414	31.32092	0.39
8	H50s002ks1(3)	0.805	0.03132	40250	1.149414	31.32092	0.43
9	H50s002ks1(4)	0.805	0.03132	40250	1.149414	31.32092	0.48
10	H50s002ks2(2)	0.795	0.03132	39750	1.135135	62.64184	0.36
11	H50s002ks2(3)	0.795	0.03132	39750	1.135135	62.64184	0.4
12	H50s002ks2(4)	0.795	0.03132	39750	1.135135	62.64184	0.45
13	H50s002ks2(2)	1.17	0.04429	58500	1.670576	44.29447	0.48
14	H50s002ks2(3)	1.17	0.04429	58500	1.670576	44.29447	0.52
15	H50s002ks2(4)	1.17	0.04429	58500	1.670576	44.29447	0.57
16	H80s001ks1(2)	0.756	0.02801	60480	0.85338	28.01428	0.35
17	H80s001ks1(3)	0.756	0.02801	60480	0.85338	28.01428	0.38
18	H80s001ks1(4)	0.756	0.02801	60480	0.85338	28.01428	0.42
19	H80s001ks2(2)	0.746	0.02801	59680	0.842092	56.02856	0.34
20	H80s001ks2(3)	0.746	0.02801	59680	0.842092	56.02856	0.37
21	H80s001ks2(4)	0.746	0.02801	59680	0.842092	56.02856	0.41
22	H80s002ks1(2)	1.07	0.03962	85600	1.207826	39.61818	0.51

23	H80s002ks1(3)	1.07	0.03962	85600	1.207826	39.61818	0.54
24	H80s002ks1(4)	1.07	0.03962	85600	1.207826	39.61818	0.58
25	H80s004ks1(2)	1.586	0.05603	126880	1.790291	56.02856	0.82
26	H80s004ks1(3)	1.586	0.05603	126880	1.790291	56.02856	0.85
27	H80s004ks1(4)	1.586	0.05603	126880	1.790291	56.02856	0.9
28	H100s001ks1(2)	0.85	0.03132	85000	0.858192	31.32092	0.43
29	H100s001ks1(3)	0.85	0.03132	85000	0.858192	31.32092	0.46
30	H100s001ks1(4)	0.85	0.03132	85000	0.858192	31.32092	0.5
31	H100s001ks2(2)	0.84	0.03132	84000	0.848096	62.64184	0.4
32	H100s001ks2(3)	0.84	0.03132	84000	0.848096	62.64184	0.43
33	H100s001ks2(4)	0.84	0.03132	84000	0.848096	62.64184	0.47
34	H100s002ks1(2)	1.25	0.04429	125000	1.262047	44.29447	0.54
35	H100s002ks1(3)	1.25	0.04429	125000	1.262047	44.29447	0.6
36	H100s002ks1(4)	1.25	0.04429	125000	1.262047	44.29447	0.65
37	H100s004ks1(2)	1.85	0.06264	185000	1.867829	62.64184	0.82
38	H100s004ks1(3)	1.85	0.06264	185000	1.867829	62.64184	0.87
39	H100s004ks1(4)	1.85	0.06264	185000	1.867829	62.64184	0.95

Table 3 Training data for the case of hydraulic rough flow experimental group.

Case	U (m/s)	u^* (m/s)	Re	Fr	Re^*	u_g^* (m/s)	
1	H50s001ks10(2)	0.221	0.02215	11050	0.315553	221.4723	0.01
2	H50s001ks10(3)	0.221	0.02215	11050	0.315553	221.4723	0.015
3	H50s001ks10(4)	0.221	0.02215	11050	0.315553	221.4723	0.03
4	H50s002ks10(2)	0.312	0.03132	15600	0.445487	313.2092	-0.025
5	H50s002ks10(3)	0.312	0.03132	15600	0.445487	313.2092	-0.02
6	H50s002ks10(4)	0.312	0.03132	15600	0.445487	313.2092	-0.015
7	H50s004ks2(2)	0.661	0.04429	33050	0.943804	88.58894	0.16
8	H50s004ks2(3)	0.661	0.04429	33050	0.943804	88.58894	0.18
9	H50s004ks2(4)	0.661	0.04429	33050	0.943804	88.58894	0.21
10	H50s004ks10(2)	0.441	0.04429	22050	0.629679	442.9447	-0.04
11	H50s004ks10(3)	0.441	0.04429	22050	0.629679	442.9447	-0.03
12	H50s004ks10(4)	0.441	0.04429	22050	0.629679	442.9447	-0.02
13	H80s001ks10(2)	0.311	0.02801	24880	0.35106	280.1428	0.011
14	H80s001ks10(3)	0.311	0.02801	24880	0.35106	280.1428	0.015
15	H80s001ks10(4)	0.311	0.02801	24880	0.35106	280.1428	0.02
16	H80s002ks2(2)	0.6	0.03962	48000	0.677285	79.23636	0.07
17	H80s002ks2(3)	0.6	0.03962	48000	0.677285	79.23636	0.11
18	H80s002ks2(4)	0.6	0.03962	48000	0.677285	79.23636	0.2
19	H80s002ks10(2)	0.44	0.03962	35200	0.496676	396.1818	-0.021
20	H80s002ks10(3)	0.44	0.03962	35200	0.496676	396.1818	-0.02
21	H80s002ks10(4)	0.44	0.03962	35200	0.496676	396.1818	-0.018
22	H80s004ks2(2)	0.9	0.05603	72000	1.015928	112.0571	0.22

23	H80s004ks2(3)	0.9	0.05603	72000	1.015928	112.0571	0.25
24	H80s004ks2(4)	0.9	0.05603	72000	1.015928	112.0571	0.28
25	H80s004ks10(2)	0.623	0.05603	49840	0.703248	560.2856	-0.1
26	H80s004ks10(3)	0.623	0.05603	49840	0.703248	560.2856	-0.08
27	H80s004ks10(4)	0.623	0.05603	49840	0.703248	560.2856	-0.06
28	H100s001ks10(2)	0.365	0.03132	36500	0.368518	313.2092	0.013
29	H100s001ks10(3)	0.365	0.03132	36500	0.368518	313.2092	0.03
30	H100s001ks10(4)	0.365	0.03132	36500	0.368518	313.2092	0.05
31	H100s002ks2(2)	0.688	0.04429	68800	0.694631	88.58894	0.11
32	H100s002ks2(3)	0.688	0.04429	68800	0.694631	88.58894	0.13
33	H100s002ks2(4)	0.688	0.04429	68800	0.694631	88.58894	0.18
34	H100s002ks10(2)	0.517	0.04429	51700	0.521983	442.9447	0.017
35	H100s002ks10(3)	0.517	0.04429	51700	0.521983	442.9447	0.02
36	H100s002ks10(4)	0.517	0.04429	51700	0.521983	442.9447	0.03
37	H100s004ks2(2)	1.023	0.06264	102300	1.032859	125.2837	0.27
38	H100s004ks2(3)	1.023	0.06264	102300	1.032859	125.2837	0.31
39	H100s004ks2(4)	1.023	0.06264	102300	1.032859	125.2837	0.34
40	H100s004ks10(2)	0.731	0.06264	73100	0.738045	626.4184	-0.043
41	H100s004ks10(3)	0.731	0.06264	73100	0.738045	626.4184	-0.022
42	H100s004ks10(4)	0.731	0.06264	73100	0.738045	626.4184	-0.001
43	H50s001ks4(2)	0.27	0.022147	13500	0.385518	88.58894	0.055
44	H50s001ks4(3)	0.27	0.022147	13500	0.385518	88.58894	0.06
45	H50s001ks4(4)	0.27	0.022147	13500	0.385518	88.58894	0.07
46	H50s001ks5(2)	0.257	0.022147	12850	0.366956	110.7362	0.03
47	H50s001ks5(3)	0.257	0.022147	12850	0.366956	110.7362	0.04
48	H50s001ks5(4)	0.257	0.022147	12850	0.366956	110.7362	0.045
49	H50s002ks3(2)	0.402	0.031321	20100	0.573993	93.96276	0.085
50	H50s002ks3(3)	0.412	0.031321	20600	0.588271	93.96276	0.09
51	H50s002ks3(4)	0.422	0.031321	21100	0.60255	93.96276	0.1
52	H50s002ks4(2)	0.39	0.031321	19500	0.556859	125.2837	0.065
53	H50s002ks4(3)	0.39	0.031321	19500	0.556859	125.2837	0.07
54	H50s002ks4(4)	0.39	0.031321	19500	0.556859	125.2837	0.08
55	H50s003ks2(2)	0.579	0.03836	28950	0.826721	76.72027	0.12
56	H50s003ks2(3)	0.579	0.03836	28950	0.826721	76.72027	0.15
57	H50s003ks2(4)	0.579	0.03836	28950	0.826721	76.72027	0.17
58	H50s003ks3(2)	0.492	0.03836	24600	0.702499	115.0804	0.1
59	H50s003ks3(3)	0.492	0.03836	24600	0.702499	115.0804	0.12
60	H50s003ks3(4)	0.492	0.03836	24600	0.702499	115.0804	0.15
61	H50s004ks3(2)	0.588	0.044294	29400	0.839572	132.8834	0.13
62	H50s004ks3(3)	0.588	0.044294	29400	0.839572	132.8834	0.15
63	H50s004ks3(4)	0.588	0.044294	29400	0.839572	132.8834	0.18
64	H50s005ks2(2)	0.703	0.049523	35150	1.003774	99.04544	0.2
65	H50s005ks2(3)	0.703	0.049523	35150	1.003774	99.04544	0.22

66	H50s005ks2(4)	0.703	0.049523	35150	1.003774	99.04544	0.28
67	H50s005ks3(2)	0.635	0.049523	31750	0.90668	148.5682	0.16
68	H50s005ks3(3)	0.635	0.049523	31750	0.90668	148.5682	0.18
69	H50s005ks3(4)	0.635	0.049523	31750	0.90668	148.5682	0.22