

APPENDIX

Table A.1 Calibration data of the 1st PVDF sensor

PVDF Sensor - 1										
Trial	Mass (g)	h ₁ (mm)	h ₂ (mm)	v ₁ (m/s)	v ₂ (m/s)	t ₁ (μs)	t ₂ (μs)	τ (μs)	V _{max} (V)	F _{max} (N)
1	0.438	400	147	2.80	1.70	37.5	62.5	25	1.1	157.68
2	0.438	400	191	2.80	1.94	37.5	62.5	25	1.14	167.33
3	0.438	400	181	2.80	1.88	38	61.5	23.5	1.03	174.67
4	0.438	400	140	2.80	1.66	36	64	28	1.03	139.49
5	0.438	400	166	2.80	1.80	38	61.5	23.5	1.13	171.70
1	0.696	400	160	2.80	1.77	38	64	26	1.52	247.7
2	0.696	400	209	2.80	2.02	38	64	26	1.61	258.4
3	0.696	400	188	2.80	1.92	38	64.5	26.5	1.53	248.04
4	0.696	400	185	2.80	1.91	38	65	27	1.53	242.65
5	0.696	400	155	2.80	1.74	38	64	26	1.4	243.35
1	1.250	400	156	2.80	1.75	38	69	31	2.07	367.01
2	1.250	400	147	2.80	1.70	38	67	29	2.28	387.90
3	1.250	400	178	2.80	1.87	38	67	29	2.26	402.60
4	1.250	400	174	2.80	1.85	38	70	32	2.2	363.21
5	1.250	400	144	2.80	1.68	38	67	29	2.3	393.18

Table A.2 Calibration data of the 2nd PVDF sensor

PVDF Sensor - 2										
Trial	Mass (g)	h ₁ (mm)	h ₂ (mm)	v ₁ (m/s)	v ₂ (m/s)	t ₁ (μs)	t ₂ (μs)	τ (μs)	V _{max} (V)	F _{max} (N)
1	0.438	400	166	2.80	1.80	38	61.5	23.5	1.13	171.70
2	0.438	400	185	2.80	1.91	38	62.5	24.5	1.12	168.28
3	0.438	400	181	2.80	1.88	38	61.5	23.5	1.03	174.67
4	0.438	400	170	2.80	1.83	38	62	24	1.17	168.91
5	0.438	400	185	2.80	1.95	38	62	24	1.18	173.27
1	0.696	400	166	2.80	1.91	38	64.5	26.5	1.52	247.23
2	0.696	400	175	2.80	1.80	38	63.5	25.5	1.53	251.44
3	0.696	400	187	2.80	1.85	38	63	25	1.62	259.15
4	0.696	400	191	2.80	1.92	38	63	25	1.71	262.63
5	0.696	400	155	2.80	1.94	38	64.5	26.5	1.57	248.84
1	1.250	400	177	2.80	1.86	38	65.5	27.5	2.58	424.087
2	1.250	400	160	2.80	1.77	38	66	28	2.3	408.3221
3	1.250	400	145	2.80	1.69	38	69	31	2.07	361.9445
4	1.250	400	162	2.80	1.78	38	66	28	2.23	409.3077
5	1.250	400	150	2.80	1.72	38	67	29	2.13	389.3919

Table A.3 Maximum Impact Forces and Mechanical Stresses on 1st Sensor

PVDF Sensor - 1							
γ [-]	R _{max} (mm)	V _{1max} (V)	F _{1max} (N)	P _{1max} (Pa)	V _{2max} (V)	F _{2max} (N)	P _{2max} (Pa)
0.80	4.50	1.95	332.67	211039	2.25	391.49	243506
0.83	4.70	1.95	332.67	2110389	2.30	401.29	248918
1.00	4.50	4	734.63	432900	2.70	479.73	292208
1.25	4.80	4.2	773.84	454545	4.80	891.49	519481
1.33	4.60	5.6	1048.35	606060	2.95	528.75	319264
1.53	3.80	2.75	489.53	297619	1.82	307.18	196970
1.59	3.65	2.3	401.29	248918	1.28	201.29	138528
1.71	4.80	4	734.63	432900	3.00	538.55	324675
1.78	4.60	3.3	597.37	357143	2.40	420.90	259740
1.88	3.20	2.1	362.08	227273	1.50	244.43	162338
1.94	3.40	4.79	889.53	518398	2.40	420.90	259740
2.00	5.00	4.9	911.10	530303	1.50	244.43	162338
3.36	3.30	1.42	232.67	155844	3.30	597.37	357143

Table A.4 Maximum Impact Forces and Mechanical Stresses on 2nd Sensor

PVDF Sensor - 2							
γ [-]	R _{max} (mm)	V _{1max} (V)	F _{1max} (N)	P _{1max} (Pa)	V _{2max} (V)	F _{2max} (N)	P _{2max} (Pa)
0.80	4.50	0.92	126.76	99567	1	142.76	108225
0.83	4.70	0.8	102.76	86580	0.85	112.76	91991
1.00	4.50	1.35	252.76	146104	1.44	230.76	155844
1.25	4.80	1.82	306.76	196970	2.1	362.76	227273
1.33	4.60	2.2	382.76	238095	1.1	162.76	119048
1.53	3.80	1.2	182.76	129870	0.6	62.76	64935
1.59	3.65	1	142.76	108225	0.45	32.76	48701
1.71	4.80	2.15	362.76	232684	1.14	170.76	123377
1.78	4.60	1.9	322.76	205628	1.1	162.76	119048
1.88	3.20	0.85	112.76	91991	0.58	58.76	62771
1.94	3.40	2.2	382.76	238095	1.2	182.76	129870
2.00	5.00	3.25	592.76	351732	0.81	104.76	87662
3.36	3.30	1.48	238.76	160173	1	142.76	108225

Table A.5 Theoretical and experimental values of impact forces and applied mechanical stresses.

γ [-]	R_{\max} (mm)	R_2/R_1 [-]	F_{1Exp} [N]	F_{12Exp} [N]	F_{1Model} [N]	P_{1Exp} [Pa]	P_{12Exp} [Pa]	P_{1Model} [Pa]
0.80	4.50	5.2	332.67	126.76	661.97	211039	99567	519740
0.83	4.70	4.7	332.67	102.76	487.45	211039	86580	410700
1.00	4.50	3.98	734.63	252.76	846.31	432900	146104	581169
1.25	4.80	2.73	773.84	306.76	838.48	454545	196970	538384
1.33	4.60	2.67	1048.35	382.76	1022.78	606061	238095	636222
1.53	3.80	2.86	489.53	182.76	523.07	297619	129870	371697
1.59	3.65	2.86	401.29	142.76	408.59	248918	108225	309748
1.71	4.80	1.73	734.63	362.76	645.51	432900	232684	371658
1.78	4.60	1.73	597.37	322.76	558.93	357143	205628	356087
1.88	3.20	2.73	362.08	112.76	308.21	227273	91991	251443
1.94	3.40	2.39	889.53	382.76	916.30	518398	238095	569986
2.00	5.00	1.26	911.10	592.76	748.43	530303	351732	436147
3.36	3.30	1.02	232.67	238.76	243.06	155844	160173	163059

F_{1Exp} – Force received during experiment by First Sensor (First Collapse)

F_{12Exp} – Force received during experiment by Second Sensor (First Collapse)

P_{1Exp} – Maximum mechanical stress during experiment by First Sensor (First Collapse)

P_{2Exp} – Maximum mechanical stress during experiment by Second Sensor (First Collapse)