LABORATORY MEASUREMENTS OF VORTEX-INDUCED VIBRATIONS OF A VERTICAL TENSION RISER IN A STEPPED CURRENT

Notes on the time series files available on the VIV data repository

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9 March 2022

These notes are to be read in conjunction with the paper "Laboratory measurements of vortex-induced vibrations of a vertical tension riser in a stepped current", by J R Chaplin, P W Bearman, F J Huera Huarte and R J Pattenden, Journal of Fluids and Structures, vol. 21 (2005) pp.3-24, where a detailed account of the experimental arrangements will be found. The data provided here consists of time series of major streams of measurements, after initial processing.

TEST CONDITIONS

The test conditions are set out in the following table, detailing 16 series of measurements. Each series consists of many individual tests covering a range of carriage speeds; there is a data file for each test.

The conditions in each series differ in respect of the tension in the riser, and the state of the vacuum tank, whether flooded with water, or filled with air.

In series 1 to 12 there are between 6 and 19 tests, at carriage speeds mostly in steps of 0.1m/s. In series 15 there are 61 tests, at increments of 0.01m/s

In series 13 and 14 the speed was ramped up and down again with reasonably constant accelerations.

Lastly, series 16 consists of a number of tests in which rapid small changes in carriage speed were imposed (both increases and decreases), after a steady state of vibrations had been established at a speed of 0.78m/s.

FILE LAYOUT

The data files have the following structure. The first row in each column contains an identifier.

Column 1: time (s)

Columns 2 -- 33: curvatures (m^{-1}) in the in-line (x) direction at the 32 strain gauge stations over the length of the riser in sequence from the bottom to the top. Positive curvature implies bending under the drag load, i.e. compression on the upstream side, tension on the downstream side. The first strain gauge station was 0.205m from the bottom of the riser and the interval between successive strain gauge stations was 0.410m.

Columns 34 -- 65: curvatures (m^{-1}) in the cross-flow (y) direction at the same points.

Column 66: carriage speed (m/s).

Column 67 and 68: bottom and top tensions (N) respectively. (The top tension load cell was not working in series 10, 11 and 12.)

Column 69: internal y- acceleration (m/s^2) at 3.44m from the bottom of the riser.

Columns 70 and 71: internal x- and y- accelerations (m/s^2) respectively at 5.59m from the bottom of the riser.

Column 72: bottom drag (N). (The drag load cell at the top of the riser was unreliable.)

The name of the original data file appears at the top of column 73.

FILENAMES

Each filename has the format DHL03_SnnRmm.csv where nn is the series number (as in the table below) and mm is the test number. Where appropriate the test numbers increase with increasing carriage speeds.

Test Series	Vacuum tube	Still water bottom tension (N)	Still water top tension (N)	Measured still water modal frequencies 1-8 (Hz)	Calculated still water modal frequencies 1-8 (Hz)	Target carriage speeds (m/s)	Database filenames (DHL03_)	Original filenames	Notes
1	Air	652	840	0.779 1.572 2.272 3.149 3.880 4.746 5.514 6.388	0.674 1.408 2.088 2.899 3.619 4.492 5.266 6.202	0.1, 0.2, 0.3, 0.4, 0.5, 0.6, 0.65, 0.7,0.8, 0.85, 0.9, 0.95, 1.00	S01R01 - S01R13	14_C001-14_C024	
2	Water	629	813	- 1.329 1.954 2.625 3.312 4.028 4.753 5.512	0.633 1.271 1.917 2.575 3.250 3.943 4.660 5.403	0.1, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8, 0.9, 1.0;	S02R01 - S02R10	15_D001-D012	
3	Water	629	813	0.692 1.141 1.975 2.642 3.330 4.053 4.777	0.633 1.271 1.917 2.575 3.250 3.943 4.660	0.1, 0.2, 0.3, 0.4, 0.5, 0.6, 0.63, 0.66, 0.7, 0.8, 0.9, 1.0,	S03R01 - S03R12	19_B001-B012	Repeat of series 2 into calmer water

				5.518	5.403			
4	Water	1000	1185	-	0.782	0.1, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8, 0.9, 1.0	S04R01 - S04R10	19_D001-D011
				1.423	1.567			
				2.394	2.358			
				3.203	3.159			
				4.024	3.973			
				4.875	4.803			
				5.704	5.651			
				6.518	6.521			
5	Water	1356	1546	-	0.899	0.1, 0.2, 0.3, 0.4, 0.45, 0.5, 0.55, 0.6, 0.65, 0.7, 0.75, 0.8, 0.85, 0.9, 0.95, 1.0	S05R01 - S05R16	20_B001-B016
				1.815	1.800			
				2.741	2.707			
				3.614	3.623			
				4.561	4.549			
				5.525	5.489			
				6.439	6.445			
				7.389	7.419			
6	Water	214	389	0.906	0.405	0.1, 0.15, 0.2, 0.25, 0.3, 0.35, 0.4, 0.45, 0.5, 0.55, 0.6, 0.65, 0.7, 0.75, 0.8, 0.85, 0.9, 0.95, 1.0	S06R01 - S06R19	21_A001-A019
				0.873	0.818			
				1.326	1.244			
				1.804	1.690			
				2.278	2.161			
				2.797	2.661			
				3.389	3.196			
				3.951	3.767			
7	Air	223	417	-	0.535	0.1, 0.2, 0.3, 0.4, 0.5, 0.6	S07R01 - S07R06	21_C001-C006
				1.017	1.071			

				1.515	1.633			
				2.103	2.199			
				2.622	2.819			
				3.353	3.439			
				3.922	4.144			
				4.666	4.834			
8	Water	1739	1925	1.037	1.015	0.1, 0.15, 0.175, 0.2, 0.25, 0.3, 0.35, 0.4, 0.45, 0.5, 0.55, 0.6, 0.65, 0.7, 0.75, 0.8, 0.85	S08R01 - S08R17	22_B001-B018	
				2.046	2.032			
				3.084	3.054			
				4.099	4.083			
				5.127	5.121			
				6.222	6.172			
				7.298	7.236			
				8.371	8.316			
9	Air	1724	1921	1.199	1.130	0.175, 0.2, 0.3, 0.5, 0.7, 0.85	S09R01 - S09R06	22_D001-D006	
				2.358	2.294			
				3.441	3.403			
				4.630	4.611			
				5.814	5.718			
				7.004	6.976			
				8.188	8.099			
				9.443	9.409			
10	Air	1704	1919	1.137	1.138	0.175, 0.2, 0.3, 0.4, 0.5, 0.55, 0.6, 0.65, 0.7, 0.75, 0.85	S10R01 - S10R11	26_A001-A011	Bearman bumps
				2.270	2.300			
				3.323	3.424			
				4.585	4.621			
					5.744			
					6.980			
					8.115			

					9.395				
11	Water	1710	1872	1.156 1.583 2.993 3.982 5.015	1.006 2.014 3.027 4.045 5.072 6.108 7.156 8.217	0.125,0.175, 0.15,0.2, 0.25, 0.3, 0.35, 0.4, 0.5, 0.6, 0.7, 0.8, 0.9, 1.0	S11R01 - S11R14	26_C001-C015	Bearman bumps
12	Water	198	360	0.492 0.953 1.292 2.297 2.841 3.491 4.130	0.394 0.805 1.241 1.644 2.206 2.734 3.332 3.967	0.5, 0.55, 0.6, 0.65, 0.7, 0.75, 0.8, 0.85, 0.9, 0.925, 0.95, 0.975, 1.0	S12R01 - S12R13	26_E001-E014	Bearman bumps
13	Water	1739	1925	1.037 2.046 3.084 4.099 5.127 6.222 7.298 8.371	1.015 2.032 3.054 4.083 5.121 6.172 7.236 8.316	Ramped up to 0.85 and back again	S13R01 - S13R02	22_C001-C002	Conditions as for series 8
14	Water	629	813	- 1.329	0.633 1.271	Ramped up to 1.0 and back again	S14R01 - S14R02	15_F001, 16_E001;	Conditions as for series 2

				1.954	1.917				
				2.625	2.575				
				3.312	3.250				
				4.028	3.943				
				4.753	4.660				
				5.512	5.403				
15	Water	629	813	-	0.633	From 0.4 to 1.00 in steps of 0.01	S15R01 - S15R61	15_E001-E027, 16_C001-C038	Conditions as for series 2
				1.329	1.271				
				1.954	1.917				
				2.625	2.575				
				3.312	3.250				
				4.028	3.943				
				4.753	4.660				
				5.512	5.403				
16	Water	629	813	-	0.633	Various step changes starting from steady conditions at 0.78	S16R01 - S16R09	16_D001-D009, 16_D020-D021	Conditions as for series 2
				1.329	1.271				
				1.954	1.917				
				2.625	2.575				
				3.312	3.250				
				4.028	3.943				
				4.753	4.660				
				5.512	5.403				