Offshore Engineering – MM575

Sheet

On Bottom Stability Assessment

1- The following data are obtained for an offshore gas pipeline:

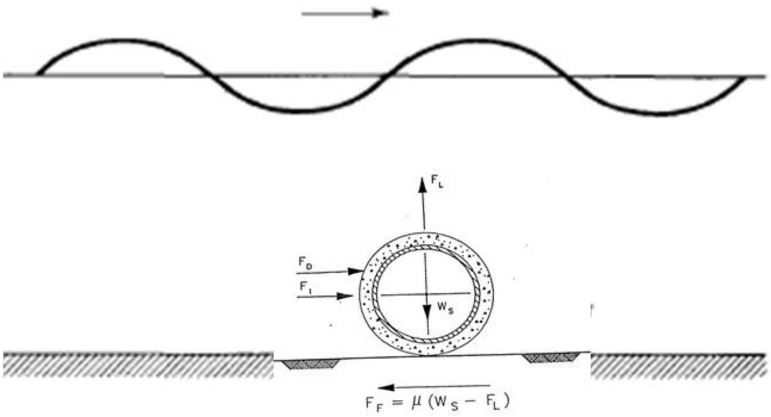

Table 1: Pipeline Data

Outside diameter of pipe D_o	0.3239 m
Nominal wall thickness t	0.0127 m
Steel density	7850 Kg/m
Sea water density	1025 Kg/m^3
Product	Gas
Density of product in pipe (ρ_p)	60 kg/m^3
Pipeline length	4.3 Km
Corrosion coating thickness t_{cc}	0.003 m
Corrosion coating density ρ_{cc}	950 Kg/m^3
Concrete coating thickness t_{con}	0.066 m
Concrete coating density ρ_{con}	2880 Kg/m^3
Seabed soil type	Sand
Friction coefficient μ	0.7

Table 2: Environmental Data

Max horizontal particle velocity	0.8 m/sec
Associated wave period T	10
Water depth d	30 m
Current speed – steady velocity	0.12 m /sec

It is required to assess the on bottom lateral stability of this oil pipeline using classification society rules, DNV RP F 109. Using both

- *Absolute Lateral Static Stability Method*
- Dynamic Lateral stability Method

as specified in the DNV RP F109 rules , determine:

- The peak horizontal force (drag+intertia) F_Y acting on the pipeline (N/m)
- The peak vertical force (Lift) F_Z acting on the pipeline (N/m)
- The frictional resistance force between pipe and seabed (N/m)
- The minimum weight required for stability (N/m)
- Is this pipeline laterally stable using this method ?
- The maximum pipe displacement in horizontal direction.
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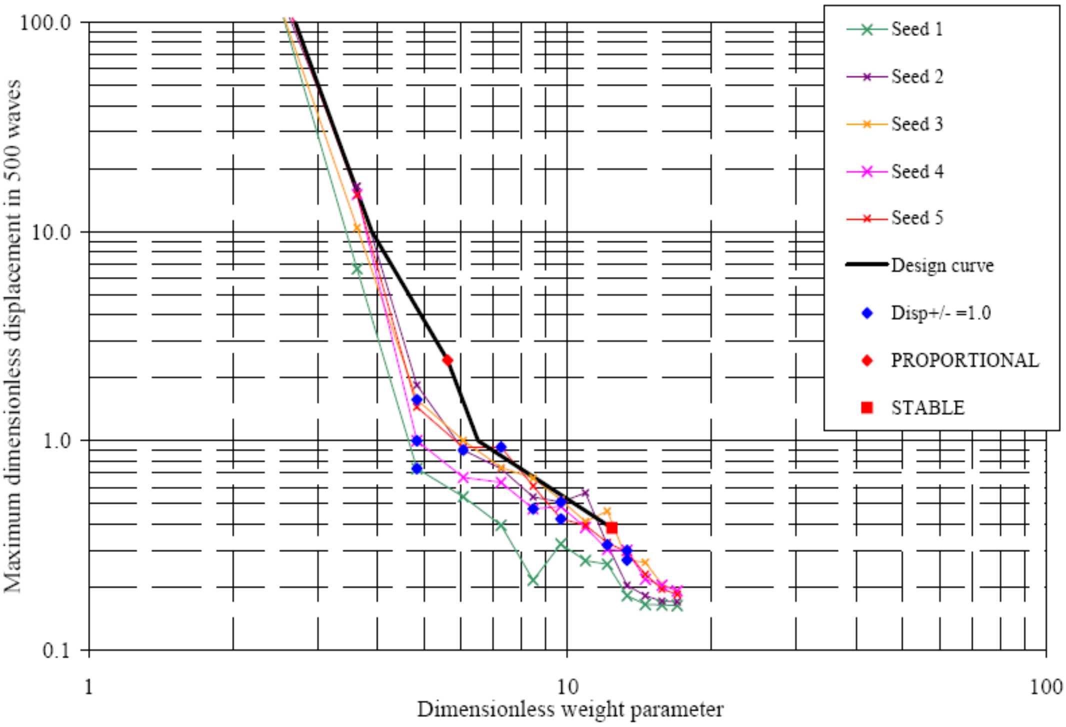
Table 3-9 Peak horizontal load coefficients

C_Y^*		K^*										
		2.5	5	10	20	30	40	50	60	70	100	≥140
M^*	0.0	13.0	6.80	4.55	3.33	2.72	2.40	2.15	1.95	1.80	1.52	1.30
	0.1	10.7	5.76	3.72	2.72	2.20	1.90	1.71	1.58	1.49	1.33	1.22
	0.2	9.02	5.00	3.15	2.30	1.85	1.58	1.42	1.33	1.27	1.18	1.14
	0.3	7.64	4.32	2.79	2.01	1.63	1.44	1.33	1.26	1.21	1.14	1.09
	0.4	6.63	3.80	2.51	1.78	1.46	1.32	1.25	1.19	1.16	1.10	1.05
	0.6	5.07	3.30	2.27	1.71	1.43	1.34	1.29	1.24	1.18	1.08	1.00
	0.8	4.01	2.70	2.01	1.57	1.44	1.37	1.31	1.24	1.17	1.05	1.00
	1.0	3.25	2.30	1.75	1.49	1.40	1.34	1.27	1.20	1.13	1.01	1.00
	2.0	1.52	1.50	1.45	1.39	1.34	1.20	1.08	1.03	1.00	1.00	1.00
	5.0	1.11	1.10	1.07	1.06	1.04	1.01	1.00	1.00	1.00	1.00	1.00
	10	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Table 3-10 Peak vertical load coefficients

C_Z^*		K^*										
		≤2.5	5	10	20	30	40	50	60	70	100	≥140
M^*	0.0	5.00	5.00	4.85	3.21	2.55	2.26	2.01	1.81	1.63	1.26	1.05
	0.1	3.87	4.08	4.23	2.87	2.15	1.77	1.55	1.41	1.31	1.11	0.97
	0.2	3.16	3.45	3.74	2.60	1.86	1.45	1.26	1.16	1.09	1.00	0.90
	0.3	3.01	3.25	3.53	2.14	1.52	1.26	1.10	1.01	0.99	0.95	0.90
	0.4	2.87	3.08	3.35	1.82	1.29	1.11	0.98	0.90	0.90	0.90	0.90
	0.6	2.21	2.36	2.59	1.59	1.20	1.03	0.92	0.90	0.90	0.90	0.90
	0.8	1.53	1.61	1.80	1.18	1.05	0.97	0.92	0.90	0.90	0.90	0.90
	1.0	1.05	1.13	1.28	1.12	0.99	0.91	0.90	0.90	0.90	0.90	0.90
	2.0	0.96	1.03	1.05	1.00	0.90	0.90	0.90	0.90	0.90	0.90	0.90
	5.0	0.91	0.92	0.93	0.91	0.90	0.90	0.90	0.90	0.90	0.90	0.90
	10	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90

For $K^* < 2.5$ the peak horizontal load coefficient can be taken as $C^*_{Y,K=2.5} \cdot 2.5/K^*$ where $C^*_{Y,K=2.5}$ is the relevant value in Table 3-9 under $K^* = 2.5$.



100.0
10.0
1.0
0.1
1
10
100
Maximum dimensionless displacement in 500 waves
Dimensionless weight parameter
Seed 1
Seed 2
Seed 3
Seed 4
Seed 5
Design curve
Disp+/- =1.0
PROPORTIONAL
STABLE