

DYNAMIC BEHAVIOUR OF OFFSHORE GUYED TOWERS

by
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C E R T I F I C A T E

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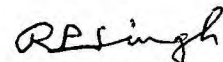
that he has pursued the prescribed course of research.



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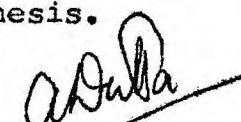
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(Amit Dutta)

ABSTRACT

The object of the present work is to study the two dimensional dynamic response characteristics of guyed towers under regular waves. Some investigations are also performed on the guyed tower mooring lines to examine their static behaviour. Three guyed towers in about 90m, 350m and 457m *water depth* available in the literature are considered for the present investigations.

The tower is modelled as a line member with the base taken as fixed against translational movement, but partially restrained against rotation. The effect of mooring system is simulated by an elastic translational spring at the guy attachment point. The (horizontal) nonlinear force-excursion relationship (when considered) of an individual mooring line is determined by an initial value finite segment technique making use of catenary equations and taking into account the stretching effect. The initial stiffness of the mooring system is considered in the tower stiffness matrix, the effect of it's nonlinearity (if present) being accounted for in the load vector by a horizontal load.

The hydrodynamic loading is evaluated taking into account the actual level of free water surface and the associated time variation in added mass. The fluid loading at a point is calculated by considering the structural velocity and the

displaced configuration of the tower. Drag and inertia coefficients are taken as either flow-dependent or constant. To evaluate the flow-dependent values the r.m.s. values of the nodal relative velocities are used.

The equations of motion in the modal co-ordinates are solved iteratively in the time domain, using Newmark ($\beta = \frac{1}{4}$) method. A two-cycle technique is applied to expedite the attainment of steady state. Mode superposition and mode acceleration methods are employed to evaluate response quantities.

The effect of lumping the distributed clump weight at a point on the force-excursion relationship of the entire mooring system and hence on the tower response are studied. The influences of different system parameters and sea floor slope on the mooring line behaviour are investigated. Guyed tower behaviour under different wave period/wave height combinations and the errors associated with the approximate solutions are discussed. Effectiveness of the two-cycle technique over the conventional time domain analysis is shown. The advantage of mode acceleration method over mode superposition method from the point of rapid convergence of results using only one or two modes in the analysis has been determined. Finally, the effects of changing deck pay load, mooring system behaviour and base rotational restraint on the tower response are examined.

CONTENTS

	<u>Page</u>
TITLE PAGE	I
CERTIFICATE	II
ACKNOWLEDGEMENT	III
ABSTRACT	IV
CONTENTS	VII
LIST OF TABLES	XIV
LIST OF FIGURES	XVII
CHAPTER 1 : <u>INTRODUCTION AND LITERATURE SURVEY</u>	1
1.1 GENERAL	2
1.2 GUYED TOWER	4
1.3 GUYED TOWER ANALYSIS : SPECIAL PROBLEMS	9
1.4 LITERATURE SURVEY	12
1.4.1 Guyed Tower Mooring System Analysis	12
1.4.2 Guyed Tower Analysis	16
1.5 OUTLINE OF THE PRESENT INVESTIGATIONS	23
REFERENCES	27
CHAPTER 2 : <u>MOORING LINE ANALYSIS FOR GUYED TOWERS</u>	33
2.1 GENERAL	34
2.2 THEORY	36
2.2.1 Model of a Single Mooring Line	36
2.2.1.1 Basic equations of a catenary	39
2.2.1.2 Line extensibility	40

	<u>Page</u>
2.2.1.3 Evaluation of excursion of a single mooring line with distributed clump weight	41
2.2.2 Evaluation of the Force-Excursion Relationships of the Entire Mooring System	46
2.2.3 Analysis of the Mooring Line Using the Lumped Clump Approach	47
2.3 ANALYTICAL PROCEDURE OF MOORING LINE	47
2.3.1 Analysis of the Mooring Line with Distributed Clump Weight	49
2.3.1.1 Initial configuration	49
2.3.1.2 Evaluation of force-excursion relationships for a single mooring line	50
2.3.1.2.1 Condition 1	51
2.3.1.2.2 Condition 2	52
2.3.2 Analysis of the Mooring Line with Lumped Clump Idealisation	53
2.3.2.1 Initial configuration	54
2.3.2.2 Evaluation of force-excursion relationships of a single mooring line.	54
2.3.2.2.1 Condition 1	54
2.3.2.2.2 Condition 2	55
2.4 TREATMENT OF SLOPING SEA FLOOR	56
2.4.1 Initial Configuration	58
2.4.2 Evaluation of Force-Excursion Relationships	61
2.4.2.1 Condition 1	62
2.4.2.2 Condition 2	63
REFERENCES	67

CHAPTER 3 : <u>STRUCTURAL MODEL</u>	69
3.1 GENERAL	70
3.2 IDEALISATION OF THE TOWER	71
3.3 EQUATIONS OF MOTION	71
3.3.1 Mass Matrix	73
3.3.2 Stiffness Matrix	74
3.3.3 Damping Matrix	75
3.4 COMPUTATION OF NATURAL FREQUENCIES AND MODE SHAPES	76
3.4.1 Normalization of Mode Shapes	80
3.5 UNCOUPLED EQUATIONS OF MOTION	80
REFERENCES	83
CHAPTER 4 : <u>HYDRODYNAMIC LOADING</u>	85
4.1 GENERAL	86
4.2 WAVES AND CURRENT	87
4.2.1 Evaluation of Water Particle Velocity and Acceleration	88
4.2.2 Evaluation of Wave Length	91
4.3 GENERATION OF FLUID LOADING VECTOR	92
4.3.1 Intensity of Horizontal Fluid Loading	92
4.3.2 Evaluation of Nodal Loads	94
4.3.3 Added Mass Correction	97
4.3.4 Flow - Dependent Drag and Inertia Coefficients	98
4.4 GENERATION OF LOAD VECTOR $\{F(t)\}$	100
REFERENCES	103

	<u>Page</u>
CHAPTER 5 : <u>SOLUTION OF EQUATIONS OF MOTION</u>	105
5.1 GENERAL	106
5.2 CONVENTIONAL TIME DOMAIN ANALYSIS	107
5.2.1 Step-by-Step Numerical Integration	108
5.2.1.1 Solution algorithm	108
5.3 TIME SAVING TIME DOMAIN ANALYSIS	111
5.3.1 Two Cycle Integration Technique	113
5.3.2 Evaluation of Modal Hydrodynamic Damping Constants	115
5.4 EVALUATION OF STRUCTURAL RESPONSE	117
5.4.1 Mode Acceleration Method	118
REFERENCES	121
CHAPTER 6 : <u>RESULTS AND DISCUSSIONS</u>	124
6.1 STUDIES ON GUYED TOWER MOORING SYSTEM	125
6.1.1 Example Problem	126
6.1.1.1 Effect of idealisation of clump weight on the force-excursion relationships	126
6.1.1.2 Influence of various parameters on the static behaviour of a single mooring line	133
6.1.1.2.1 Line extensibility	134
6.1.1.2.2 Length of clump weight (with the total weight of clump as constant)	134
6.1.1.2.3 Initial inclination of the mooring line at the fairlead	136
6.1.1.2.4 Horizontal component of initial tension at the fairlead	136

	<u>Page</u>
6.1.1.2.5 Submerged unit weight of clump weight (keeping length of clump weight as constant)	140
6.1.1.2.6 Anchor line length	142
6.1.1.2.7 Guy attachment level	143
6.1.1.3 Effect of sea floor slope on the mooring line behaviour	146
6.2 STUDIES ON DYNAMIC BEHAVIOUR OF GUYED TOWERS	155
6.2.1 Exxon Model Tower	156
6.2.1.1 Influence of rotatory inertia on natural frequencies and mode shapes	158
6.2.1.2 Selection of suitable time step for time domain solutions.	159
6.2.1.3 Performance of mode acceleration method and minimum number of modes needed for obtaining tower response with acceptable accuracy	165
6.2.1.4 Effectiveness of iterative two-cycle integration technique	172
6.2.1.5 Dynamic behaviour of Exxon model tower under different wave period/wave height combi- nations	175
6.2.2 Exxon Prototype Tower	188
6.2.2.1 Performance of mode acceleration method and minimum number of modes needed for obtaining tower response with acceptable accuracy	192
6.2.2.2 Dynamic behaviour of Exxon prototype tower under different wave period/wave height combinations	204
6.2.2.2.1 Effects of neglecting structural displacement and velocity in fluid loading, and also variable submergence on tower response	208
6.2.2.2.2 Influence of flow dependent drag and inertia coefficients on tower response	212
6.2.2.2.3 Effect of lumping the distributed clump weight at a point on tower behaviour	216

6.2.2.2.4	Assessment of error involved in Penzien's solution	221
6.2.3	Brown & Root Tower	225
6.2.3.1	Dynamic behaviour of Brown & Root tower under different wave period/wave height combinations	229
6.2.3.2	Effect of changing various parameters on tower response	236
6.2.3.2.1	Deck pay load	237
6.2.3.2.2	Horizontal force-excursion relationship of the entire mooring system at guy node	240
6.2.3.2.3	Base rotational spring stiffness	245
6.2.3.3	Performance of iterative two-cycle integration technique	247
	REFERENCES	251
CHAPTER 7:	<u>CONCLUSIONS AND RECOMMENDATIONS FOR FUTURE WORK</u>	253
7.1	CONCLUDING REMARKS - STATIC BEHAVIOUR OF GUYED TOWER MOORING SYSTEM	254
7.2	CONCLUDING REMARKS - DYNAMIC BEHAVIOUR OF GUYED TOWERS	257
7.3	RECOMMENDATIONS FOR FUTURE WORK	260
	REFERENCES	263
	APPENDICES	264
APPENDIX-A	A PROCEDURE FOR INCLUSION OF 'P-DELTA' EFFECT IN THE TOWER ANALYSIS	265
APPENDIX-B	PREDICTION TECHNIQUE USED IN THE TWO CYCLE METHOD	267