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**Integrity of an offshore
structure subjected to waves**

TESE DE DOUTORADO

DEPARTAMENTO DE ENGENHARIA MECÂNICA

**Programa de Pós-Graduação em
Mecânica Aplicada**

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Victor Fernando Deorsola Sacramento

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waves**

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Thesis presented to the Programa de Pós-Graduação em Mecânica Aplicada of the Departamento de Engenharia Mecânica, Centro Técnico Científico, PUC-Rio, as partial fulfillment of the requirements for the degree of Doutor em Mecânica Aplicada.

Advisor : Prof. Rubens Sampaio Filho
Co-Advisor: Prof. Thiago Gamboa Ritto

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I dedicate this work to my wife, Adriana, to my daughter Maria Carolina and to my son, Pedro Henrique. During the time that I dedicated to this work I stopped doing a lot of things together with them.

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Abstract

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This work presents a method for evaluation of the fatigue resistance of a drilling tower considering the sea surface elevation, the dynamics of the platform on which the tower is installed and the dynamics of the tower itself. Reduced order models are used for obtaining the sea surface elevation and the dynamics of the tower, and the uncertainties on the parameters of the components of the system can be included in the analysis as well. The analysis can be done for several sea states, according its probability distribution, and no assumption about the probability distribution of the stress ranges has to be made previously. The histogram for the distribution of stress ranges for the entire working life of the equipment is obtained using a Rainflow technique. The results and the uncertainties on them are discussed.

Keywords

Random ocean waves; Karhunen Loève basis; Reduced-order model; Dynamics of offshore structures; Fatigue damage;

Resumo

Sacramento, Victor Fernando Deorsola; Sampaio Filho, Rubens; Ritto, Thiago Gamboa. **Integridade de uma estrutura offshore sujeita à ondas**. Rio de Janeiro, 2014. 82p. Tese de Doutorado — Departamento de Engenharia Mecânica, Pontifícia Universidade Católica do Rio de Janeiro.

Este trabalho apresenta um método para calcular a resistência à fadiga de uma torre de perfuração considerando a elevação da superfície do mar, a dinâmica da plataforma na qual a torre está instalada e a dinâmica da própria torre. Modelos de ordem reduzida são utilizados para obter a elevação da superfície do mar e a dinâmica torre, e as incertezas nos parâmetros dos componentes do sistema podem ser incluídas na análise também. As análises podem ser feitas para vários estados de mar, conforme sua distribuição de probabilidade, e nenhuma hipótese sobre a distribuição de probabilidade precisa ser feita inicialmente. O histograma de distribuição de ciclos de tensão para toda vida útil do equipamento é obtido usando um procedimento de contagem de ciclos Rainflow. Os resultados e as incertezas nos mesmos são discutidos.

Palavras-chave

Ondas oceânicas aleatórias; Base de Karhunen Loève; Modelo de ordem reduzida; Dinâmica de estruturas offshore; Dano em fadiga;

Contents

1	Introduction	11
2	Sea Surface Elevation	15
2.1	Regular Waves	16
2.2	Irregular Waves	17
2.3	Short-term Statistics	18
2.4	Wave Spectrum	21
2.5	Long-term Statistics	22
2.6	Reduced-order Model	24
2.7	Direct Method	26
2.8	Snapshots Method	27
3	Dynamics of the Platform	29
3.1	Equation of Motion	30
3.2	Hydromechanical Loads	32
3.3	Wave Loads	33
3.4	Response in Regular Waves	38
3.5	Response in Irregular Waves	39
4	Dynamics of the Drilling Tower	42
4.1	Partial Differential Equation	42
4.2	Approximation to the Solution	44
4.3	Reduced-order Model for the Dynamics	46
4.4	Stress at Critical Points	49
4.5	Parametric Uncertainty	51
5	Fatigue Analysis	53
5.1	Palmgren-Miner rule	53
5.2	Stress Range Distribution Evaluation	54
5.3	Uncertainties in Fatigue Life Prediction	61
6	Results	64
7	Summary and Conclusions	75
	Bibliography	79

List of Figures

1.1	Overview of the procedure	14
2.1	Obtaining the sea surface elevation	16
3.1	Drilling tower mounted on a platform	29
3.2	Sketch of the platform	30
3.3	Movements of the platform	31
3.4	Obtaining the loads over platform	33
3.5	Obtaining the dynamics of the platform	38
4.1	Obtaining the base excitation	42
4.2	Sketch of the tower	43
4.3	Obtaining the dynamics of the tower	45
4.4	One-dimensional element	45
4.5	Assembly of the elements	46
4.6	Obtaining the stress time history	50
5.1	Calculating the structural integrity	53
6.1	PM spectrum	65
6.2	Sea surface elevation	65
6.3	Original x reduced-order model	66
6.4	Sea surface elevation at cylinders	67
6.5	Total wave loads	68
6.6	Platform displacement	69
6.7	Platform rotation	69
6.8	Stress time history at critical point	71
6.9	Histogram and Gaussian pdf	71
6.10	Histogram and Weibull pdf for entire simulation	72

List of Tables

6.1	Main parameters of the equipment	64
6.2	Significant wave height probability	66
6.3	Rates of utilization of the equipment	70
6.4	Influence of the uncertainty	73
6.5	Parameters for MATLAB [®] programs	73