

Modelling and Simulation of Parallel Motion Fender



Engineering

KEYWORDS : Analysis, Modeling, Shear stress, FEM, Fender

Mehul D. Gohil

P. G. Student, L. D. College of Engineering Mechanical Department, Navrangpura, Ahmedabad

Praful G. Patil

P. G. Student, L. D. College of Engineering Mechanical Department, Navrangpura, Ahmedabad

U.V. Shah

Associate Prof. L. D. College of Engineering Mechanical Department, Navrangpura, Ahmedabad.

ABSTRACT

-In this study, the collision analysis for the fender system that designed for protection of collision between vessel and Port was performed. For the DWT4000 size of design objective vessel, the impact forces and the impact energies were estimated by data from port, and the Parallel motion fender systems were designed based on the estimated forces and energy. The impact analysis have the dynamic nonlinear features, such as, material nonlinear, large deformation and contact, explicit structural analysis program was used. The reaction force as fender systems are evaluated and analyzed. The consideration of fender system in calculation of collision force is need for optimum design. Here force applied on 90° and 10° angles and results simulated.

INTRODUCTION

In the early years as marine transport slowly evolved, ports and terminals were built to receive small, lightly loaded vessels and ships with small drafts reflecting the shallow navigable channels through which they passed. Marine transport has grown to become an integral part of most nation's economy as it has also proved to be the most inexpensive way of moving heavy goods over very long distances. Today, Naval architects have been successful in designing larger vessels that transport cargo at faster speeds across the ocean. Hence, ports and terminals need to be adequately designed for the berthing of these massive vessels without damage to the ship or the dock structure and often the ship channels must be dredged to accommodate these ships. On the other hand, very deep draft ships which are moored further from the terminal in deep water perhaps due to the near-shore shallow non-navigable channel are subject to sea waves resulting in increased concerns of ship motion response in the design of fendering systems.

OBJECTIVE

The objective of the present study is to increase the life of fender and reduce failures due to cyclic load by Modeling and Simulation of fender for life, type of failures, and failure location by varying its design parameter like plate thickness, plate location and L/D ratio.

MODELLING

Creo Parametric 1.0 is used for Modelling. It is a computer graphics system for modeling various mechanical designs for performing related design and manufacturing operations. The system uses a 3D solid modeling system as the core, and applies the feature base parametric modeling method. In short Creo Parametric 1.0 is a feature based parametric solid modeling system with many extended design and manufacturing applications.

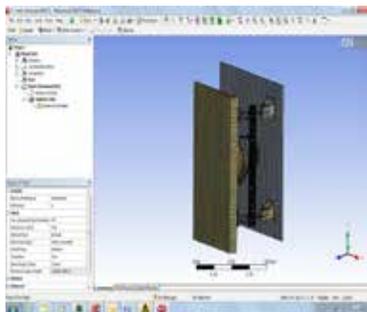


Figure 1: Modelling and Meshing of PM Fender.

MESHING

A Meshing is done by using ANSYS 12.0.

- Type of Mesh:- 3D
- Type of Element: - Tetrahedral (10 Node)
- Number of Nodes:- 157312
- Number of Element:- 63037

This Solid-187 Element, Tetrahedral (10 Node) has plasticity, hyper elasticity, Creep, Stress, Stiffening, Large deflection and large strain capabilities.

ANALYSIS

FEM was used to analysis. The Analysis of the parallel motion fender system and simulations, due to complicated loading and geometry of problem. A nonlinear static analysis was performed. This analysis was performed with Computer Program ANSYS, version 12.1.

MAXIMUM SHEAR STRESS CONTOUR

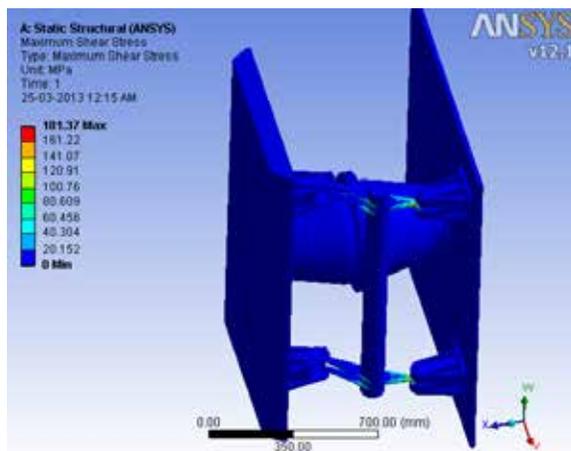


Figure 1: Analysis Contour of PM Fender.

TABLE 1 RESULTS AND DISCUSSION

No. of Analysis	Force Angle	Force Applied	Equivalent Stress Max.	Max. Shear Stress (Max.)	Fatigue Life (Min.)
1.	90°	62993 N	337.82.Mpa	181.37 Mpa	4558 Cycles
2.	10°	62993 N	371.63 Mpa	199.81 Mpa	4216 Cycle

CONCLUSIONS

Above Results shows that Maximum Stresses Occurs at the Torque arm Attachment and Minimum Life is also generated at the torque Arm which shows that FE Analysis accurately matches with Experimental Results which indicate that FE Analysis is a good tool to Replace Costly and time consuming experimental work.

REFERENCE

- [1] H.-W. L. a. S.-W. Y. Gye-Hee Lee, "AN ANALYSIS OF STEEL FENDER SYSTEM FOR VESSEL," *Ocean Engineering*, p. 8, 2004. | [2] D. U. Gokdeniz Nesser, "Dynamics of ships and fenders during berthing in a time domain," *Ocean Engineering*, pp. 1919-1934, 2005. | [3] M. K. Shigeki Sakakibara, "Ship berthing and mooring monitoring system by pneumatic-type fenders," *Ocean Engineering*, p. 1174–1181, 2006. | [4] M. G. Zhiyu Jiang, "Optimization of a fender structure for the crashworthiness design," *Materials and Design*, p. 1085-1095, 2009. | [5] R. Wuttrich, J. Wekezer, N. Yazdani and C. Wilson, "PERFORMANCE EVALUATION OF EXISTING BRIDGE FENDERS," *JOURNAL OF PERFORMANCE OF CONSTRUCTED FACILITIES*, 2001.