DESIGN OPTIMIZATION AND VALIDATION THROUGH FE ANALYSIS OF PARALLEL MOTION FENDER

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Abstract— In port area the problem of handling of large vessels at river bank is arises from many years. Many research has been gone throw in this area and one of the generalize solution has been found by using fender. A fender is the interface between a ship and the shore facilities. Generally, its main objective is to protect the ship’s hull from damage. In some cases it’s the shore facilities that require protection against impact of the ship. But the failure of fender is new problem that faces by the designer because of the heavy impact of the ship. This work regarding to the redesigning of the parallel motion fender that fails under torsion arm and give the probable solution for remove this problem. For achieving optimize parallel motion fender we use spring with outside guide to give it sufficient stiffness and move it parallel. Here force is applied at 0°, 10° and 20°.

Keywords: Ship, Parallel Motion Fender, Torque Tube, Torque pin, Spring, Optimization

I. INTRODUCTION

It was once stated, some years ago, “there is a simple reason to use fenders: it is just too expensive not to do so”. Although it may be a rather pragmatic and one-sided view, there certainly is a germ of truth in the statement. In addition to the financial aspect, safety is probably an even more important reason to install fenders. Nowadays it is common practice to apply fender assemblies comprising energy-absorbing rubber elements in ports which have to accommodate large vessels. However, port authorities have an approach which is both commercial and practical; therefore, if conditions allow (relatively small vessels, mild environments conditions), ports may optimize for the installation of low cost fenders and/or apply locally available material. Wooden fenders, rubber tyres or the like are therefore still regularly encountered all over the world, even in major ports. Parallel Motion Fenders were conceived to overcome the shortcomings of conventional fenders. A parallel motion fender consists of a fender panel, similar to a conventional panel but backed by only a single fender unit (or pair of units mounted together) at its center. To support the fender panel and to restrain it so that it is always vertical, it is mounted on a pair of arms which project from a torsion tube. The connection between the arms and the panel is hinged and the torsion tube itself is mounted on hinges.

II. PROBLEM DEFINITION

Base on review, there is no work done regarding to failure of fender. From literature survey, we can say that parallel motion fender widely used because of its functional and operational accuracy than other type of fender. But in conventional parallel motion fender main load bearing element is torque arm which sustain the entire jerk and impact load. Due to heavy loading, torque arm often fails.

In this work, our aim is to use parallel motion fender with spring to increase stiffness and guide support to move complete parallel during compression.

III. MODEL OF PARALLEL MOTION FENDER

![Fig. 1: Model of Parallel Motion Fender](image1)

IV. MESHING OF PARALLEL MOTION FENDER

![Fig. 2: Meshing of Parallel Motion Fender](image2)
V. APPLY SHIP FORCE

![Image of Apply Transient Force](image1)

Fig. 3: Apply Transient Force

VI. RESULT OF PM FENDER (FOR 0 DEGREE ANGLE SHIP IMPACT) EQUIVALENT (VON- MISES) STRESS

![Image of Result of PM Fender (For 0 Degree Angle Ship Impact)](image2)

Fig. 5: Result of PM Fender (For 0 Degree Angle Ship Impact)

VII. RESULT OF PM FENDER (FOR 10 DEGREE ANGLE SHIP IMPACT) EQUIVALENT (VON- MISES) STRESS

![Image of Result of PM Fender (For 10 Degree Angle Ship Impact)](image3)

Fig. 6: Result of PM Fender (For 10 Degree Angle Ship Impact)

VIII. RESULT OF PM FENDER (FOR 10 DEGREE ANGLE SHIP IMPACT) EQUIVALENT (VON- MISES) STRESS

![Image of Result of PM Fender (For 20 Degree Angle Ship Impact)](image4)

Fig. 7: Result of PM Fender (For 20 Degree Angle Ship Impact)

IX. RESULT & DISCUSSION

![Image of Table 1: Results](image5)

<table>
<thead>
<tr>
<th>At Torque Arm Attachment</th>
<th>0 Degree</th>
<th>10 Degree</th>
<th>20 Degree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Material ST 52 – 355 MPa</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Von Misses Stresses(MPa)</td>
<td>228.69</td>
<td>449.96</td>
<td>699.04</td>
</tr>
<tr>
<td>Factor of Safety</td>
<td>1.46</td>
<td>0.74</td>
<td>0.50</td>
</tr>
</tbody>
</table>

Table 1: Results

From this result we can say that maximum stresses occur at the torque arm attachment and minimum life is also generated at the torque arm. For 0 degree ship impact, fender is capable for sustaining load. For 10 degree and 20 degree ship impact, fender is not capable to sustain load and minimum life is generated at the torque arm. so in next chapter we modify design and try to reduce stresses and increase life of parallel motion fender.

REFERENCES

[1] Guidelines for the design of fender 2002- PINAC
[2] Dr. MoujalliHourani, Mr, Reeves Whitney, Mr. Raymond Gizzi P.E “Fender system selection using ansys.”
[7] Tim beckett. “Parallel Motion Fenders; Some design consideration including immersion of fender cone”