Design of a controlled side launching system for tugboats

PRESENTED BY: JUAN SEBASTIAN CARDONA

MECHANICAL ENGINEER. MSC IN COMPUTATIONAL MECHANICS. MSC IN NAVAL ARCHITECTURE

ADVISOR: ASSOCIATE PROFESSOR RENARDO FLORIN TEODOR, "DUNAREA DE JOS" UNIVERSITY OF GALATI
Content

- LAYOUT
- MOTIVATION
- GRAVITATIONAL SIDE LAUNCHING SYSTEM IN DAMEN
- SPECIFICATIONS
- DESIGN PROPOSAL
- DETAILED DESIGN OF TIPPING TABLE:
- CONCLUSIONS
- ACKNOWLEDGEMENTS
GRAVITATIONAL SIDE LAUNCHING SYSTEM IN DAMEN SHIPYARDS GALATI
**TUGBOAT CHARACTERISTICS**

<table>
<thead>
<tr>
<th>Characteristic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length</td>
</tr>
<tr>
<td>Beam</td>
</tr>
<tr>
<td>Draught</td>
</tr>
<tr>
<td>Displacement</td>
</tr>
</tbody>
</table>
MOTIVATION

- Lifting capacity of the cranes restrict the launching by crane.
- Violent movement at the edge of the slipways.
- Risk of skidding and tilting the ship before reaching the water.
- Risk of impact between the wooden supports and hull.
- Risk of impact between cradle and vessel.
GRAVITATIONAL SIDE LAUNCHING SYSTEM IN DAMEN SHIPYARDS GALATI

\[ \sum F = m_{\text{total}} \cdot a = F_{\text{grav}} - F_{\text{friction}} - F_{\text{drag cradle}} - F_{\text{drag vessel}} \]

\[ \Delta \alpha = f(V, \Delta t, K_\alpha, \lambda_\alpha) \]

\[ \sum F = m_{\text{total}} \cdot a = F_{\text{buoyancy}} + \lambda_y \]
REQUIREMENTS

- The system must be demountable or temporary system.
- Possibility of recover ships (Optional).
- The system must be modular.
- The demountable system must weigh less than the lift capacity of the two cranes.
- The system must consider the different sceneries of launching regarding the level of the river.
- Not speed launching requirements but launching must be slow and controlled.
- Accessibility for Lorries coming with the ship.
DESIGN PROPOSAL (Tipping table)
DESIGN PROPOSAL (Tipping table)
DESIGN PROPOSAL (Tipping table)
DESIGN PROPOSAL (Tipping table)
DETAILED DESIGN OF TIPPING TABLE
(Structural Analysis) Security factor calculation
DETAILED DESIGN OF TIPPING TABLE
(Kinematic analysis at 0 m)
DETAILED DESIGN OF TIPPING TABLE
(Kinematic analysis at 3.95 m)
CONCLUSIONS

- The controlled side launching system fulfil all the specifications and requirements of the design.
- The design structure accomplishes with the minimum security factor of SF=1.2.
- The results found for the scenery of 3.95 m (from the level zero) shows a high risk of damage of the vessel.
- The controlled side launching system can be adjustable regarding the water level of the river.
- Extremely low water condition results give and safety launching without risk of damage.
- The computational model developed in the study, shows realistic behavior. However, must be validated rigorously before use it as tool.
ACKNOWLEDGEMENTS

We express our deepest thanks to “Dunarea de Jos” University of Galati, Ecole Central de Nantes and University of Liege and all the Professors involve in the EMSHIP program.

Many tanks to DMT Company and its engineer department for the total and unconditional support during the whole process of design.

Specially tanks to workers from Damen Shipyards Galati who advice and welcome me.

GRACIAS
SPECIFICATIONS

- System is designed for launch ships with the maximum capacities of the Stan tugboat 4511.
- The total capacity of one slipway is 600 tons (biggest tugboat weight 900 tons).
- Ship maximum size 15 m beam (biggest tugboat 14 m beam).
- Ship maximum size 45 m length (biggest tugboat 45 m length).
- Reach draught enough to release the vessel (around 5.6 m).
- Launching speed about 0.1 m/min.