

Ship Vibration Problems and Remedies

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March 19, 2021

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Introduction

Ship vibration is attributed to unbalanced reciprocating machinery, hull vibration due to wave action, propeller excitation etc.

In the present day, ship vibration is of such importance that it is taken into account in the design stage. The crux of the matter is to ensure that natural frequency of the hull and machinery does not match within the ship service speed range so as to give rise to resonant condition. This requires elaborate calculations of all the significant modes of vibration.

Vibration Sources

The potential sources of vibration in ships are:

1. Local vibration like rattling, creaking in fittings and engine vibration.
2. Rudder vibration caused by torsional oscillation and bending oscillation, fluttering of rudder.
3. Propeller excitation causing axial and torsional vibration of propeller shaft.
4. Engine excitation due to external unbalance and flywheel effect.

Vibration Identification

Key observations to identify vibration:

1. Engine rpm corresponding to significant vibration.
2. Direction of vibration, transverse or longitudinal.
3. Frequency of vibration.
4. Position of maximum and minimum vibration.
5. Nature of local vibration.
6. Engine rpm causing hammering of steering gear and tail shaft.

Vibration Mitigation

The remedy for ship vibration include:

1. Installing vibration insulating materials, firmly securing bolts and screws, using engine mounting made of resilient materials and increasing scantlings in areas prone to vibration.
2. Rudder design prioritizing natural frequency over max operating speed. To avoid flutter rudder must be designed to have maximum rigidity against torsion and flexure.
3. Propeller design ensuring smooth water flow, adequate clearance between blade tip and hull and sufficient structural stiffness of propeller disc.
4. Favorable firing order of the engine and fitting crankweb balance to negate resultant moment.

Conclusion

Conclusion

Vibration has plagued the shipping industry since its inception, with the advent of new propulsion systems the source of vibration may have altered, however the challenge of mitigating vibration in order to ensure sound ship operation and the well being of her crew and passenger is a top priority.

Decades of research and practical know how has led to some innovative solutions to this ubiquitous problem and the era of electronic computing has granted the opportunity to model ship vibration such that the present day ships are more optimized in design to counter phenomenon and are oriented towards crew and passenger comfort.

Bibliography

Bibliography

1. "A review of ship vibration problem", W. Ker Wilson, 1956.
2. "Practical Approach to Some Vibration and Machinery Problems", T. W. Bunyan, 1955.

Thank You.