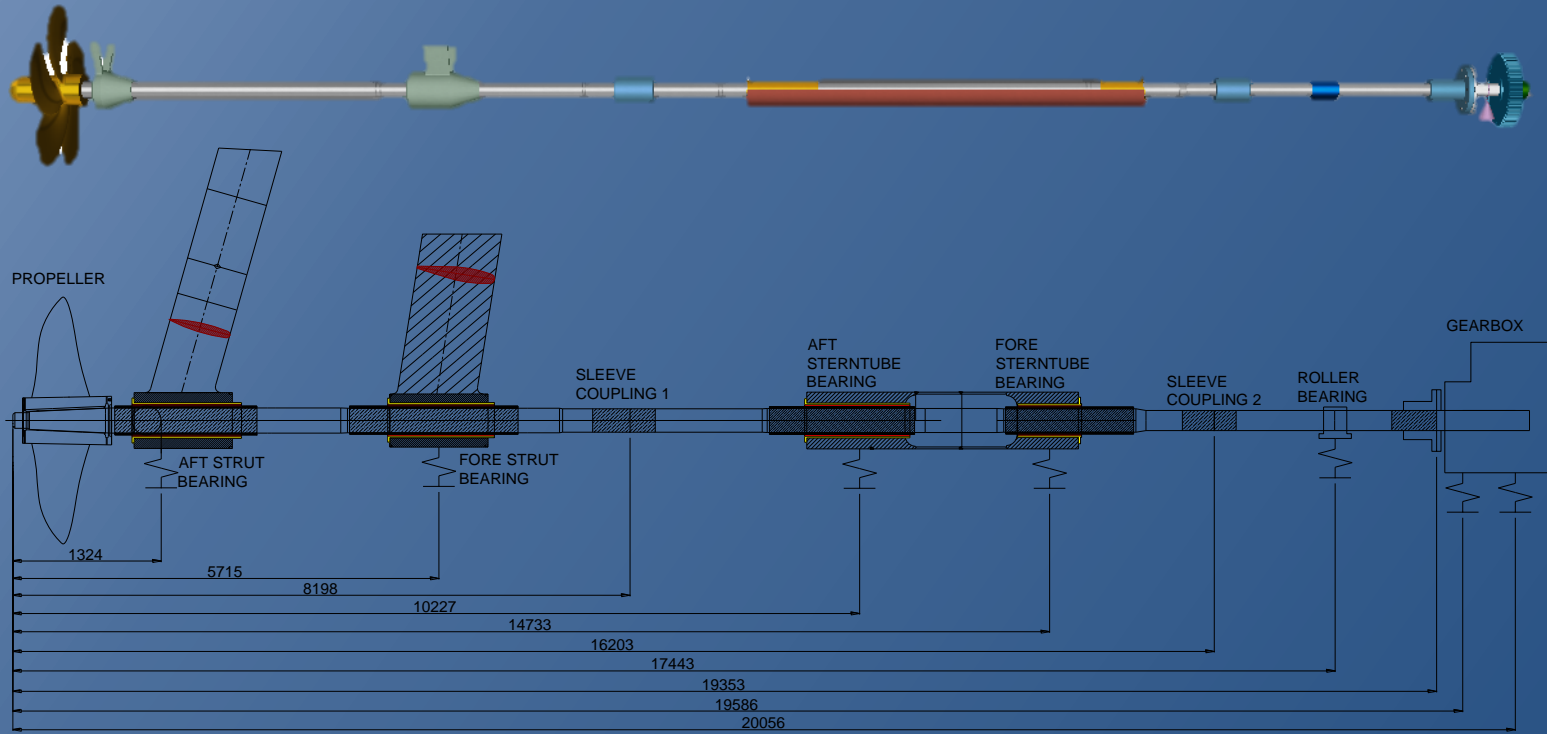


*Axial, Lateral & Torsional Vibration Analysis*



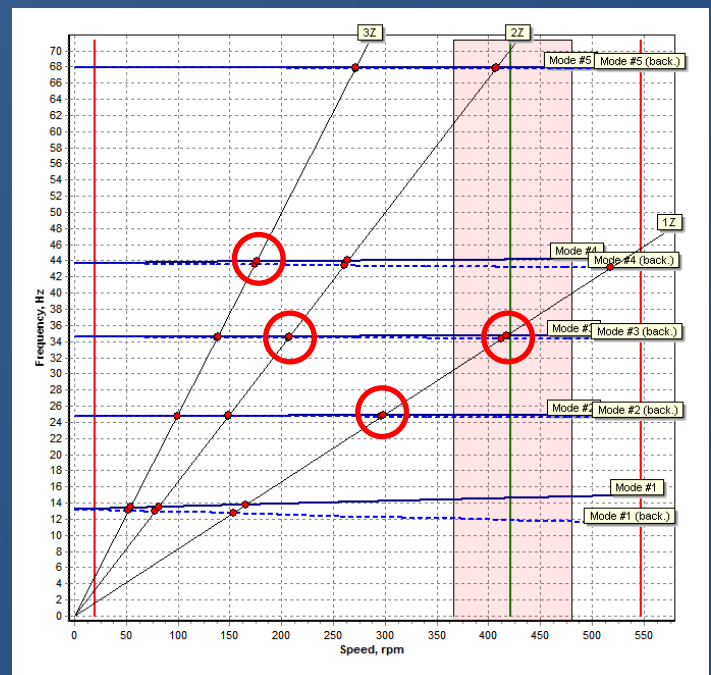
Type: Frigate  
 Overall length: 86 m  
 Overall Beam: 11 m  
 Engines: CATERPILLAR C280-16  
 MCR: 4600 KW @ 900 RPM

Vibration analysis of new Frigate is required. Axial, lateral and torsional vibration calculations were done by TECNAVIN S.A. to select the correct propulsion elements to avoid vibration problems in ship operation.

Axial, bending & whirling and torsional vibration analysis were done by Tecnavin S.A.

From the preliminary designed system, Shaft Designer software calculation show that there is a bending resonance on critical working range.

System modification was studied to avoid this resonance.



Lateral Campbell Diagram – original system

Axial vibration:

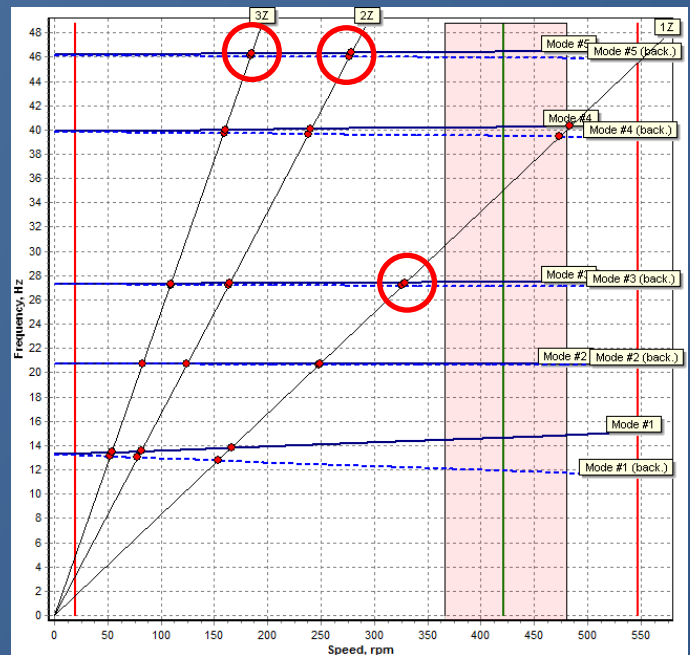
Propeller critical frequency was found at engine 479RPM

Bending & whirling vibration: Shaft Designer software

Stuffing box bearing relocation and roller bearing elimination were studied on vibration analysis. Using the Bending vibration analysis, the resonance on the lower critical range was eliminated due to the modifications performed.

Torsional vibration analysis: TORCAL software

- Vibratory stresses
  - Vibratory torque
  - Power loss
  - Angular deformation
- Analysis of all propulsion components including engine, damper, couplings, gearbox, shafts, etc.
  - Standard analysis and misfiring condition
  - Propeller coupled and uncoupled analysis.
  - Analysis with Classification Societies requirements.
  - Selected propulsion elements are appropriate for this propulsion system.



Shaft Designer Lateral Campbell Diagram - modified system

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593-9-84166936

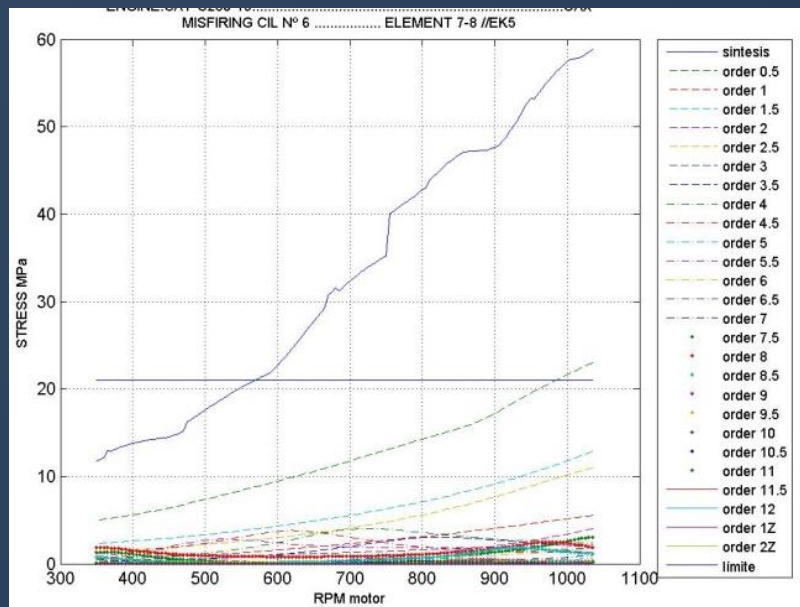
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RESULT FROM TORSIONAL VIBRATION ANALYSIS

Propulsion system components are adequate for ship operation on the actual working range



TORCAL software  
Stress result on crankshaft