

## 12. FEM CALCULATIONS

Deltamarin expertise in FEM calculations can be of great help for the Shipowner. For example, shipyard and class calculations can be verified or special items not included in the shipyard's scope can be checked.

Structural design is supported by relevant technical calculations. Demands for complex structures require direct strength calculations to complete calculations based on simple rule. Accurate description of structures and loads enables finding out reliable responses.

Finite element method (FEM) is used to carry out a large variety of static and dynamic analyses for dimensioning and verification purposes:

- **Strength analyses of hull girder**  
*3-D global half/full breadth FE-model, coarse element mesh*
  - Longitudinal strength calculations: Global sea loads (bending moment and shear force)
  - Longitudinal strength of fore ship: Bow impact loads
  - Racking / transverse strength calculations: Inertia forces and inclined sea loads
  - Docking calculations: Actual loading condition and docking plan
  
- **Strength analyses of structural major/minor details**  
*3-D/2-D local FE-model, fine/extremely fine element mesh*
  - Load carrying capacities of ship structures/equipment: Calculated stresses and deformations versus design criteria according to rules, for example bow structures/bow doors under bow impact loads
  - Fatigue strength analyses: Hot spot stresses for fatigue life calculations
  - Strength calculations based on non-linear features: Ultimate strength (collapse)
  
- **Vibration analyses of hull girder**  
*3-D global half/full breadth FE-model, coarse element mesh*
  - Free vibration solutions (natural frequencies): Mass distribution and added mass
  - Forced vibration responses: Damping and exciter loads
  
- **Vibration analyses of local structures**  
*3-D/2-D local FE-model, fine element mesh*
  - Free vibration solutions (natural frequencies) of typically pillar-supported deck panels, mast structures etc.

### Selected References:

- ✓ Vibration analysis of generator set base plate for Wärtsilä Diesel
- ✓ Strength analysis of the power plant barge for Wärtsilä Diesel
- ✓ Analysis of the collapse of the heavy lifter m/v Fairmast using a whole ship FE-model
- ✓ Strength calculations of World of ResindenSea using whole ship FE-model
- ✓ Analysis of the bow structure of m/v Silja Festival

- ✓ Analysis of the bow structure of m/v Robin Hood
- ✓ Structural analysis of the m/v Carthage
- ✓ Analysis of the lengthening of m/v Sally Albatross
- ✓ Vibration analysis of forward part of the superstructure of Superfast V & VI for HDW