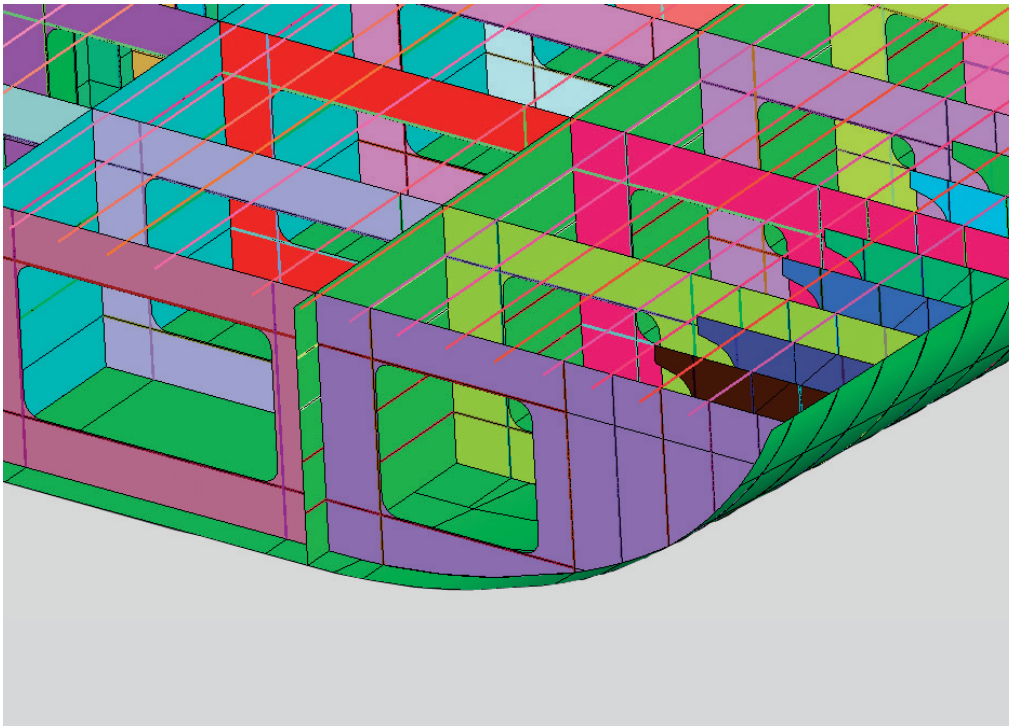


## 2. Basic Design

1. Initial Design
2. Basic Design
3. Hull Structure
4. Machinery & Outfitting
5. Electrical Design
6. Drafting & Mechanical CAD
7. PLM Integration
8. Virtual Reality
9. Change & Access Control

The FORAN innovative approach for the basic design stage ensures the highest quality and a smooth transition to further stages



FORAN addresses the basic design through its 3D modelling environment, which supports a quick, preliminary 3D definition of the structural and outfitting elements in terms of global geometry, attributes and scantling, in an extremely efficient manner. The FORAN model is used for:

- FEM export, by means of an automatic idealization tool that provides bi-directional communication with any FEM suite
- Class drawing extraction, using the FORAN drafting tools, with automatic update of drawings after changes in the model
- Generation of P&I diagrams
- Weight calculation and gross material estimate
- Outfitting and machinery 2D or 3D layouts
- Detail and production design. The model can be progressively broken down and detailed, for which FORAN offers a great number of automatic and interactive functions

The FORAN structure model is topological, so changes introduced are automatically propagated to topologically dependent structures and to drawings.

## Structure Basic Design

### Surface Model

FORAN Initial Design provides two approaches for surface definition:

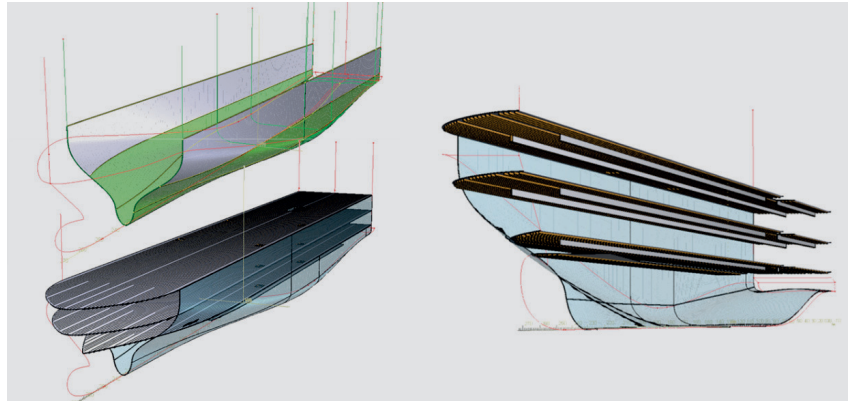
- Definition of all surfaces and import from any third party surface
- Modification of existing forms, marine transformation methods
- Modification of forms from curves, keeping boundary conditions
- Pattern based definition of decks and parametric bulkheads (planar, corrugated and extruded)
- Topology between surfaces

### Hulls and Decks Structure

**Shell and deck plates** can be modelled as areas of common grade and scantling, limited by any 3D curve on the surface (butts, seams, knuckles, etc.). These areas can be divided and detailed if the design progresses.

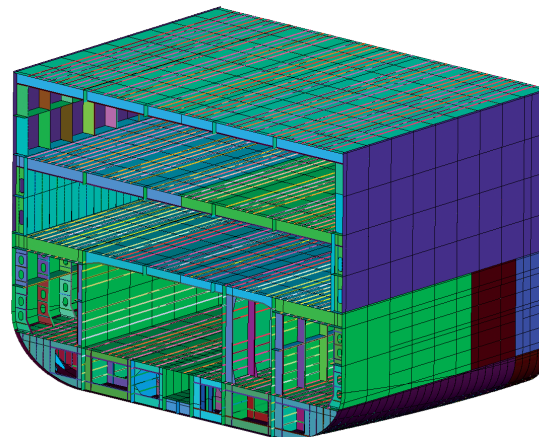
FORAN can insert sets of **longitudinals** on each surface, from end to end, and chop them at the points of change of scantling. As in the case of plates, stiffeners can be later detailed and split at block or part limits.

**Openings** can be defined projecting any 2D geometry on the surface. FORAN provides clipping of all the plates and stiffeners affected by the opening. Small openings can be included and filtered out when exporting the model to FEM.



### Internal Structure

FORAN provides tools for defining planar, multi-planar or corrugated structures. In many cases, **bulkheads, floors, web frames and beams, stringers**, and other structural members can be easily defined just with one click on a sequence of intersection lines, automatically provided on each working section. The smart or topological copy is of special interest at basic design.



## FEM Export

FORAN structure model is created in true shape. Plate and profile elements are rendered as BREP solids including thickness, openings, end cuts and other details automatically introduced.

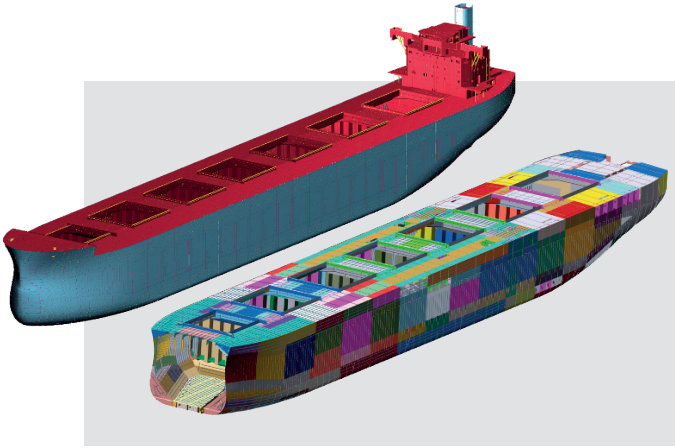
For global FEM analysis, FORAN provides an **idealization tool** that simplifies the structure

model removing thickness and non-relevant details, and then applies the necessary stretch or shrink to the elements to ensure that contacts and connections are kept.

FORAN divides all plate and profile elements at any contact and intersection. The result is exported in IGES or STEP formats, which can be easily meshed in most pre-processors.

The scantling and grade of each element is exported too.

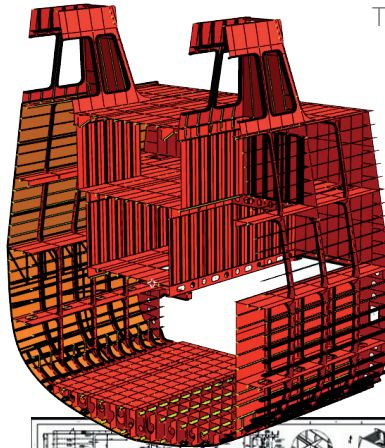
In addition to the global ship analysis, the detailed model can be directly used for local and fatigue analysis. Export to STEP, IGES, JT and other standard formats are available.



### Engine Room and Outfitting Layouts

Outfitting and machinery layouts can be defined in the FORAN GA tool (provided for ship configuration at the early stages of the project). This application follows the FORAN model-to-drawing approach, but provides also a 2D drafting environment, DXF compatible, that includes functions for placing and modifying equipment on the ship views.

The 3D model is automatically updated when 2D is modified.



### Class Drawings

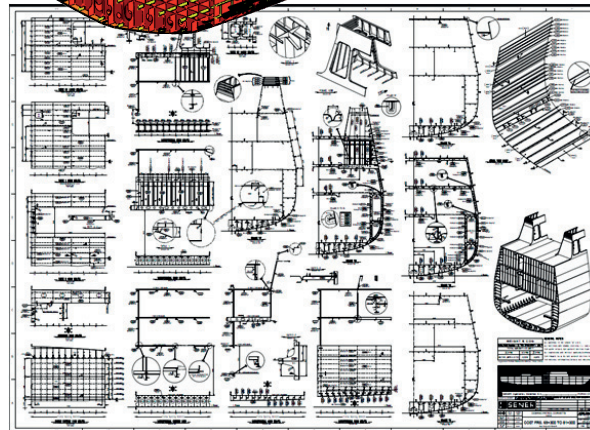
The FORAN drafting environment provides tools to create **structure class drawings from the 3D model**, and to update drawings after changes. It is DXF compatible. Some remarkable features are the smart labelling, at drawing generation.

### Outfitting Basic Design

#### P&Is

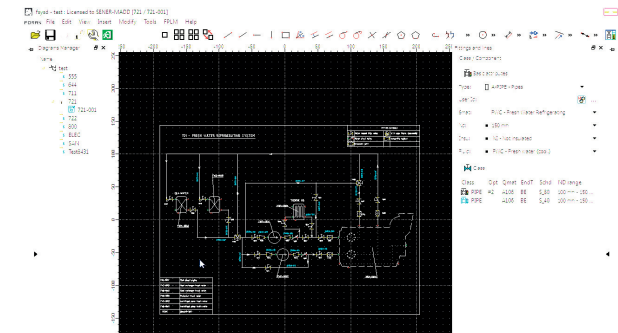
FORAN provides a smart 2D generator for piping, instrumentation and electrical schematics. Equipment, pipes and other elements on the diagram are transparently assigned with technological data and attributes from the libraries on the database.

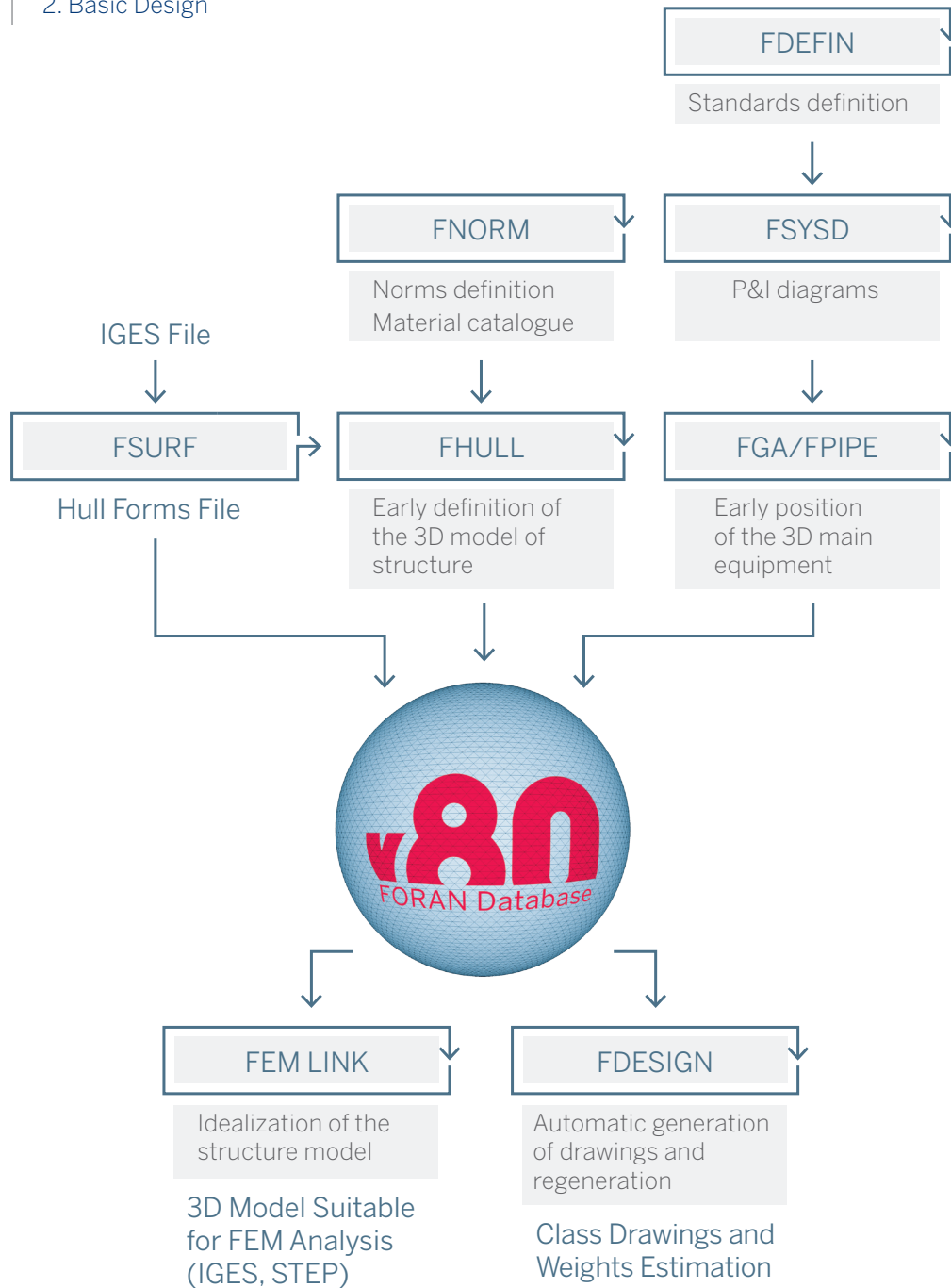
FORAN schematics are DXF compatible and fully integrated with the 3D in both ways. Other key features are the connection consistency between equipment or fittings symbols and distributors, the automatic assignment and on-line edition of properties to elements, part lists generation and management of multi-sheet diagrams.



### Weight and Materials Estimation

FORAN provides accurate weight calculation of all parts included in the 3D model with thickness, actual scantlings, openings, lengths, diameters,... The 3D model can produce material estimates in terms of tons of steel, areas of plate for each thickness and grade, total length for each profile section, material and scantling, number and type of fittings, pipes and equipment.





### FORAN Basic Design Benefits

- Efficient tools for the early definition of the structure model in 3D, and automatic generation of class drawings
- Idealization capability of the 3D model of structure to ensure a suitable export to FEM tools in standard formats, enabling a considerable reduction of man-hours in the overall process
- Smart definition of P&I diagrams connected to the 3D model
- Automatic class drawing update after changes in the 3D model
- Early definition of main equipment layout
- Smooth transition to detail and production stages, by adding geometry and attributes
- Accurate estimation of weights and material at early design stages