

FUNCTIONAL AND CONSTRUCTION PARTICULARITIES OF THE SHIPS FURNITURE

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ABSTRACT

The functional conditions on the ships lead to the variety of interior design on the ships, having influences on the construction, functionality and aesthetical shape of the furniture. They are as follows: limited and restraint space, functional role and destination of each room; multifunctional spaces; ships movement: rolling, rocking, variation of level, rotations and vibrations; environment issues: high relative air- humidity, salt medium, random meteorological conditions; multifunctional furniture (for resting, office purpose, lunch purpose, games and fun); diversity of materials of the ships structure and of the furniture on the ships. The paper presents the most important furniture structures, the adequate constructive presumed shapes (rounded corners and edge battens), materials, textures, colours, fittings and other. All these are useful for designers, engineers who build or up to date the ships. The paper shows the connection between the aspects related to furniture and the variation of the interior arrangements.

Keywords: ships furniture, FEA, optimisation, interior arrangements, multiple functions

1. INTRODUCTION

During their efforts to know and control the planet, people were forced to create means of transport designed for the three environments, thus being constructed water, ground and air vehicles.

A special place in ships construction belongs to the wood as material, beginning with the first rudimentary shapes of boats – raft, one-trunk boat, canoe, Eskimo kayak or Indian canoe and concluding with the most advanced wooden ships in the glorious period of the geographical discoveries, when the technical and the exploitation ship knowledge were harmoniously interacted with the wood decorative art.

The ship builders concern for interior arrangements and ship furniture design in order to assure the passengers and crew comfort during the travel is relatively new, starting with the second half of the 19th century and continuing also today.

Once the technical and constructive problems are solved, the optimum solutions of the interior space arrangement depending on the shipload and route must be found. Thus, a continuous concern to optimise the necessary living space on the ship must be observed, realized through a rigorous arrangement according to international principles and conventions, being attractive and comfortable in the same time, as the psycho-emotional features of the passengers and crew require. The ship interior arrangement means both to equip the cabins according to their functions (sleeping cabins, control cabin, social activities cabins) and to assure the comfort and safety of the crew on the ship.

The two aspects –functions and comfort must be organically connected, without diminishing the aesthetic function of the interior arrangement.

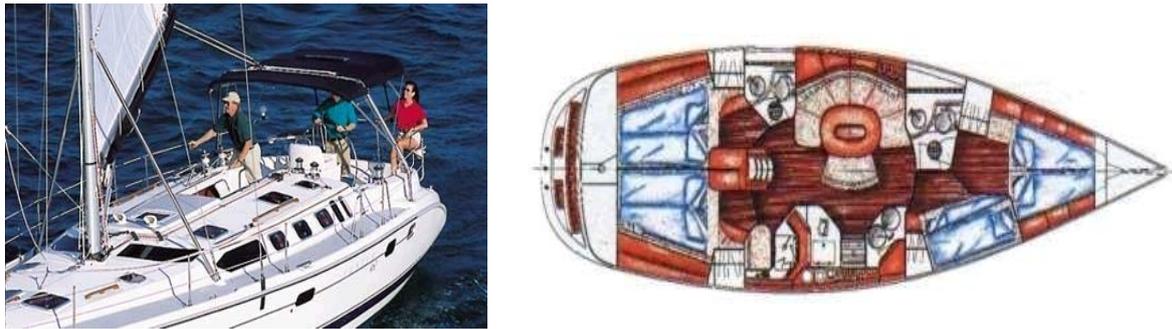


Figure 1: Yacht interior arrangement

Thus, from the functional point of view, a lot of the well known pieces of furniture and the necessary accessories (for furniture, lightning, hygienically ones), control apparatus and/or utilitarian apparatus, have been adapted to the ship conditions according to the following principles: multifunctional principle, dimensional principle in narrow spaces, using resistant materials to the degradation action of different factors (high air humidity, salinity, sun radiations, wear, corrosive agents), being aesthetical in the same time, possible to be processed and interchangeable, avoiding the crew injuries and the deterioration of the objects during the travel by designing and manufacturing pieces of furniture having the size, shape, accessories and the possibilities of anchoring them on the floor and/or on the walls, so that to offer safety, no matter of environment conditions (storms, waves, rocking, rolling).

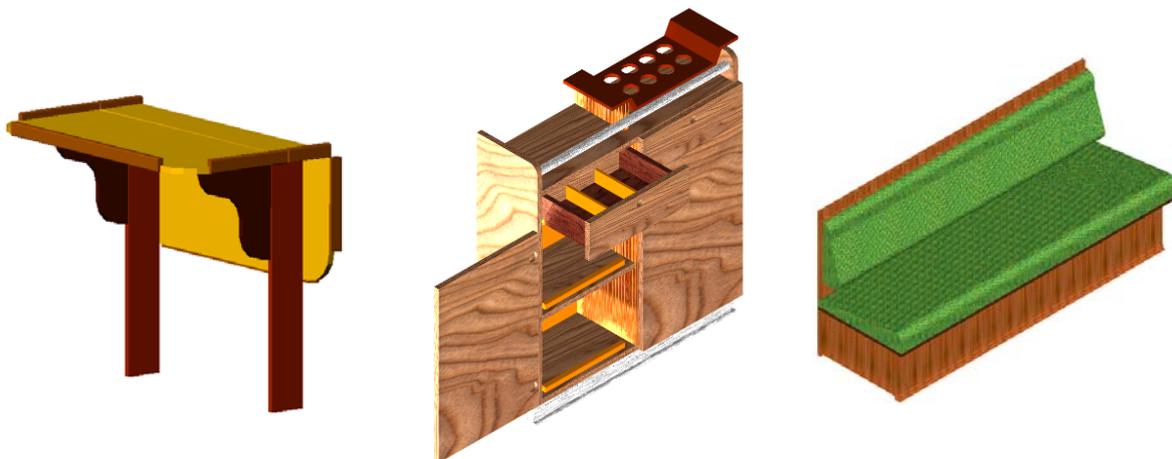


Figure 2: Structure types of ship furniture

Ship furniture design operation is a provocation of the imagination when creating the three necessary directions: functionality -constructive and economic reason – aesthetical function. Thus, the design engineer, during the creation process, knowing the phenomena which could lead to the movement and/or the overturning of the furniture or of the other objects during the travel (waves, rocking, rolling...) becomes a visionary, because he has to anticipate the human reactions and behavior in that situations, and thus, based on them, to design resistant furniture to the destructive factors and safe one. Not accidentally the majority of the pieces of furniture on the pleasure ships are provided with anchorages on the floor and/or on the walls, which fix the furniture and in several cases which use properly the “air” space on the ship.

2. THE NUMERICAL TEST

Several pieces of furniture have been designed for yachts. It has been considered that the most exposed piece of furniture to the above mentioned factors is the table, as a central piece, no matter of the design procedure – with two legs, a central metal or wooden leg, with a common or folding top table, round, square, oval or rectangular shape, edge battened, etc.

Two particular cases have been analysed through the finite element method (FEM): two tables – with a central leg and with two legs, in both cases the top table being made of plywood and the legs of steel. For each particular case several variants of calculus have been established through varying some

parameters (distance between edge and legs, the interior leg diameter d , the thickness h of the leg walls, the position of the load and its intensity).

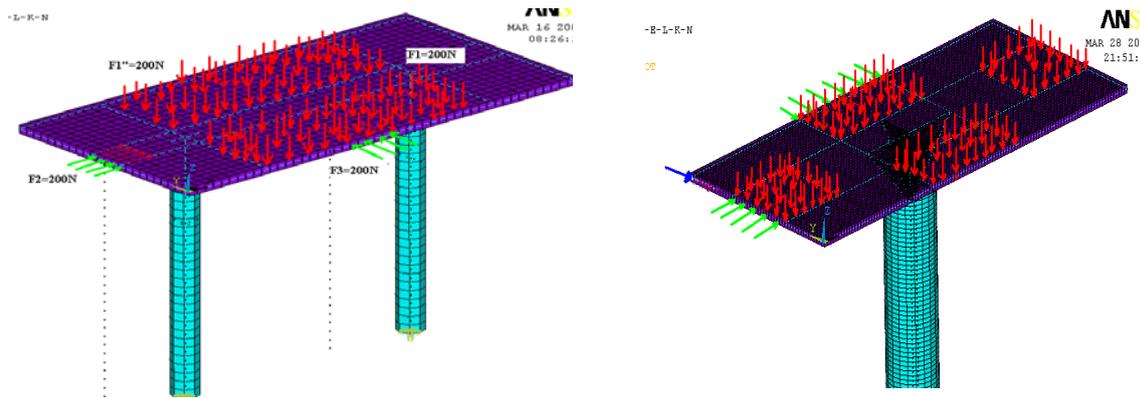


Figure 3: Stresses distributions on the table

3. RESULTS AND DISCUSSIONS

FEM analyse emphasizes the following aspects with regards to the stresses and movement of the structural points of the tables with one and two legs:

- Position and the intensity of the loads which have direct influence on the stresses and movement fields (normal and tangential ones);
- Rising the distance between the table top edge and the legs position leads to the accented increasing of the stresses and the linear movements;
- reducing the thickness of the top table with 15 %, leads to increasing the stresses and the points movement with 20 % ;
- rising the ratio D/d of the table legs section leads to increasing of stresses and decreasing the points movement;
- in case of the table with one central leg, the stresses are increasing 28%. times in comparison with the similar situation of using two legs in the table construction;
- The table top shape (rectangular, circular, elliptical) has influence on the stresses and points movement fields.

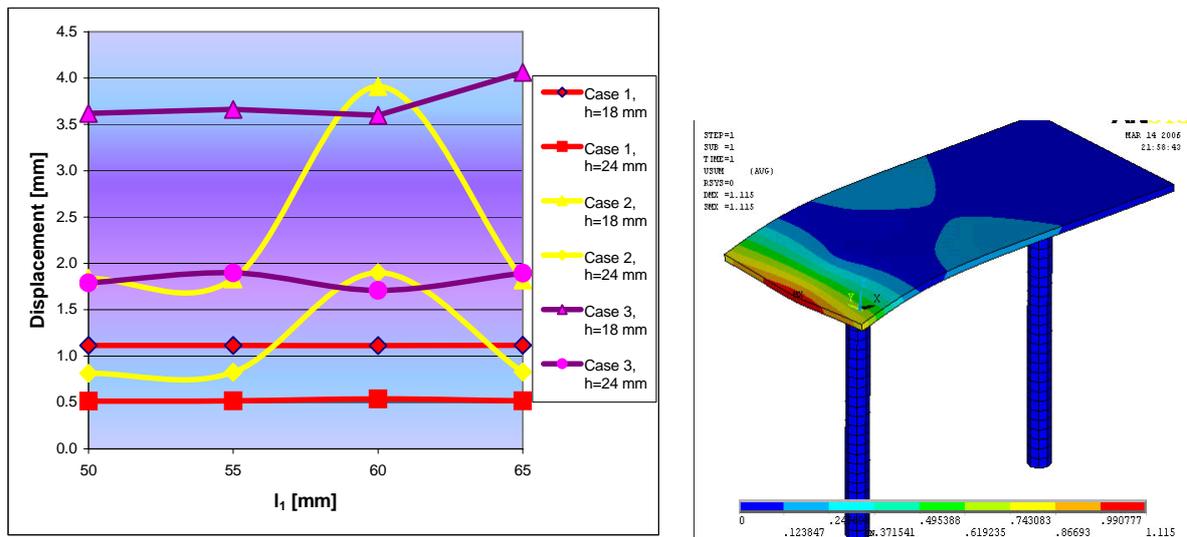


Figure 4: Variation of the movements as function of interior diameter (d) of the legs and panel thickness (h)

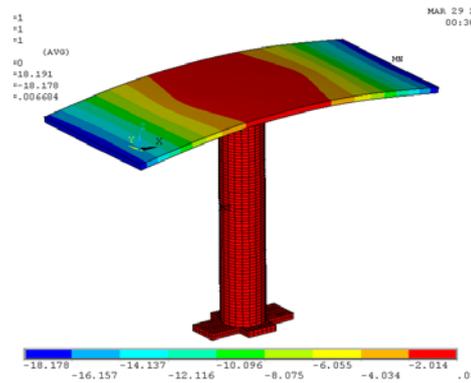
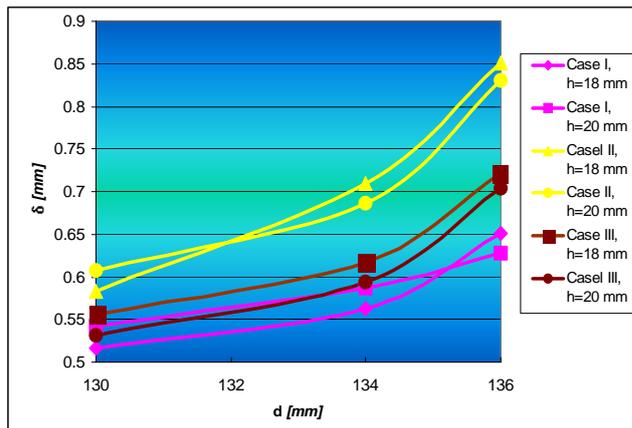


Figure 5: Variation of the total movements (δ from the leg, against the variation of interior diameter (d) for $D = 140$ mm, cases I, II, III and the panel thickness ($h = 18$ and 20 mm).

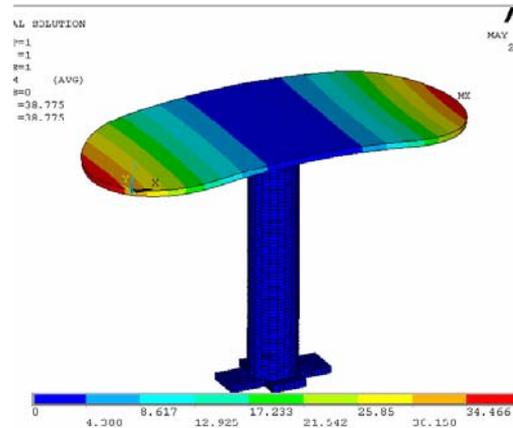
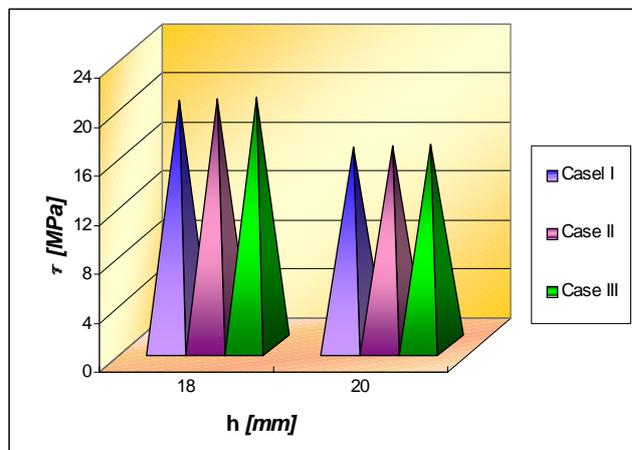


Figure 6: Variation of the shear stresses (τ in the xy plane, the panel thickness ($h=18$ and 20 mm) in the three cases of loading types

4. CONCLUSIONS

The narrow space and the conditions specific to the ships structure have influence on the constructive shape and structure of the ship furniture.

The furniture must be manufactured as knock-down one, with anchorages on the floor and on the walls, with shapes that prevent the passengers and crew personnel injuries; made of hydro-, fire – and fungi- resistant materials, etc.

Using FEM analyse, the sizes and the structure of different types of pieces of furniture could be optimise so that to have high resistance and rigidity, stability, friability and low costs.

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