



# ALGORITHM AND IMPLEMENTATION TO OBTAIN A CONFORMING BED AND 2D-BENDING TEMPLATES IN INDUSTRIAL SHIP SYSTEM



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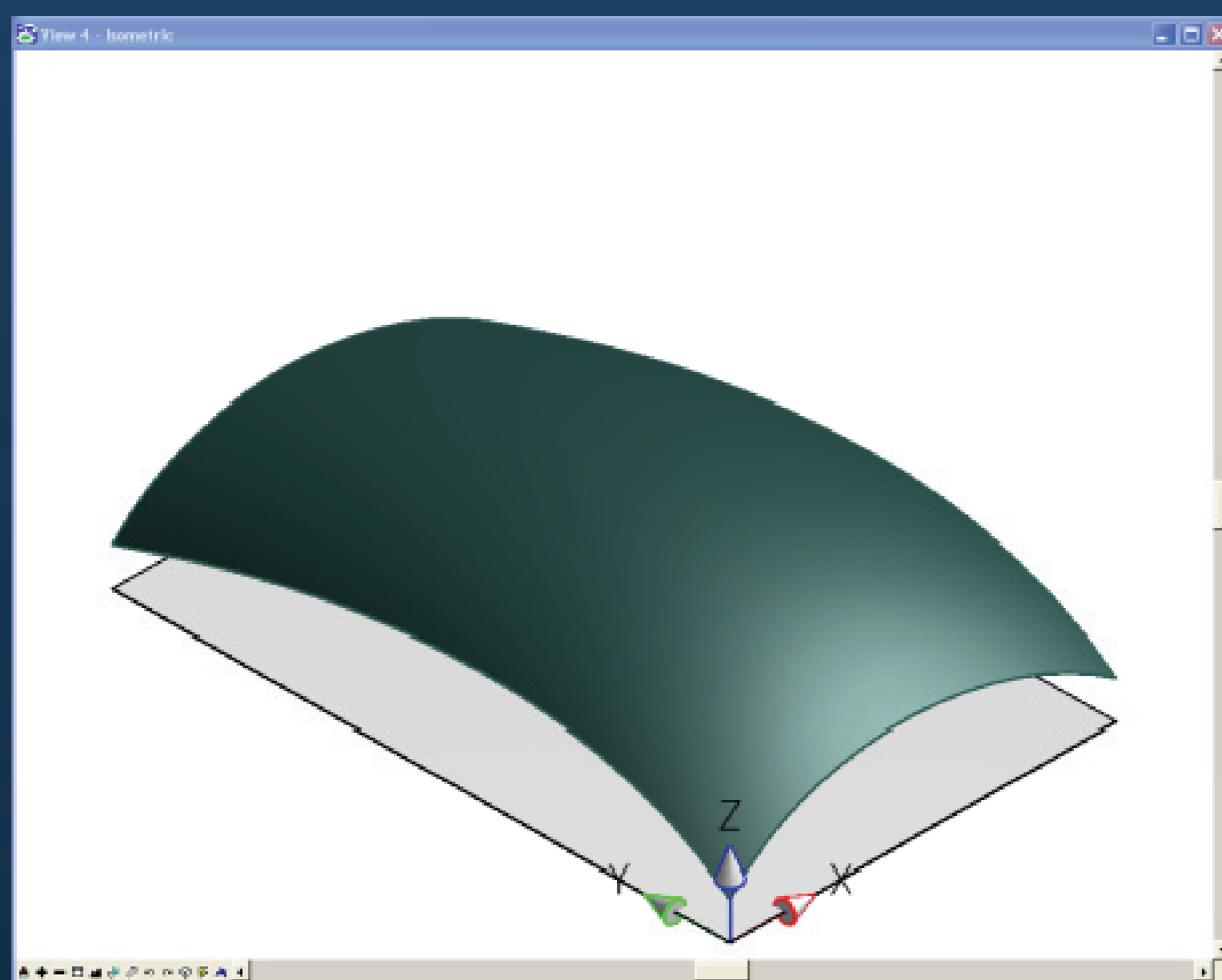
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## SUMMARY

This article presents an implementation of a new algorithm for all templates needed for cutting and shaping the plates in an Industrial Ship System: the conforming bed and 2D-bending templates. The displayed method is based on the obtaining of the necessary distances, between the quadrangular mesh and the curved surface, for the verification of plate bending used in the construction of the ship's steel hull. A complete tool, integrated in the Industrial Ship System, has been obtained, which provides precision and speed, and enables it to handle all the necessary information for shaping in plans and reports.



## DEVELOPMENT FOR THE CONFORMING BED

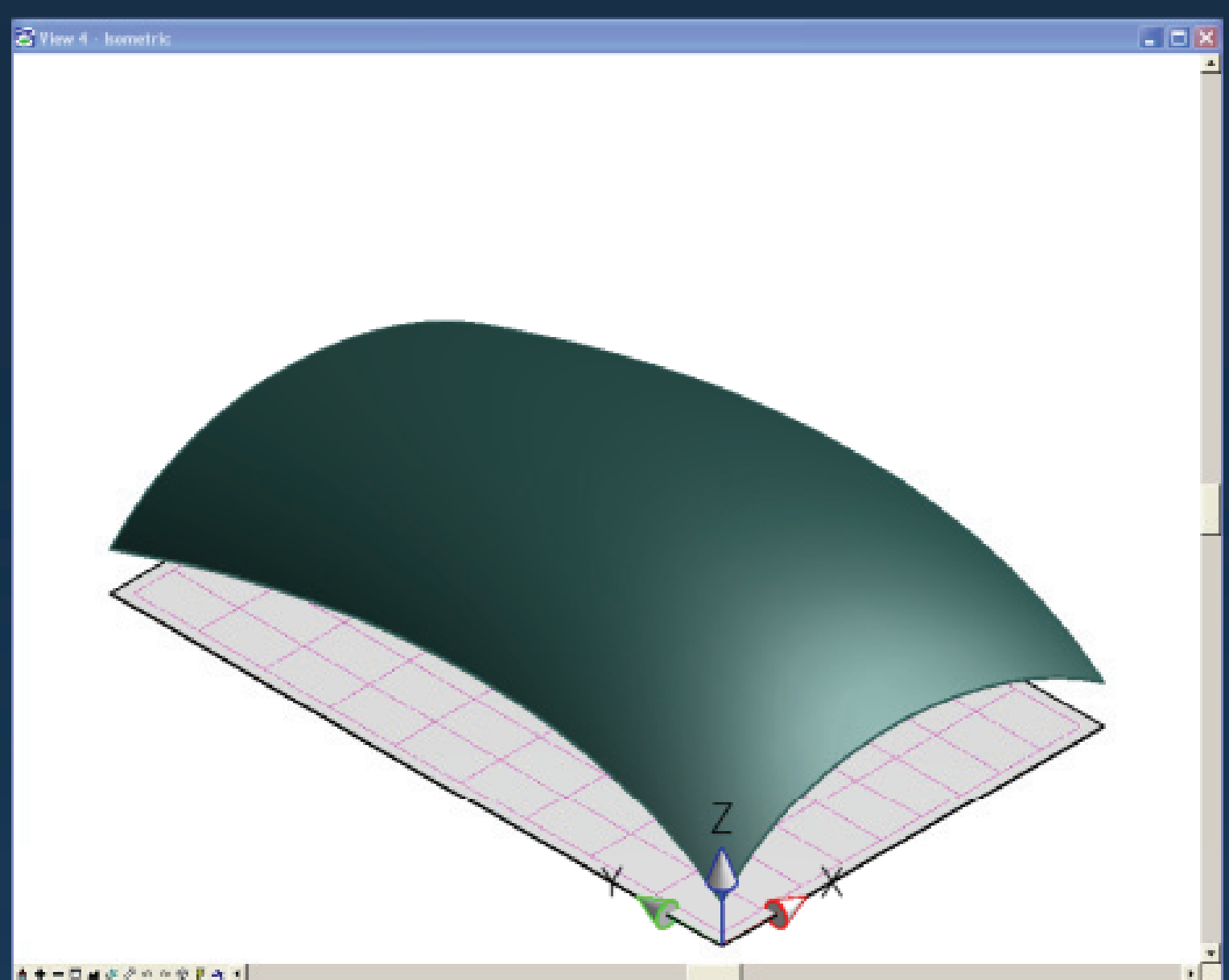


Step 1: Auxiliary plan. The selected auxiliary plan is the same which has been used in the meshing process

Step 2: Projection of the plate edges using the same tool as for the development tool.

Step 3: Choice of a projection vertex from the origin edges and two orthogonal directions as parametric axes: L x T (Longitudinal and Transversal).

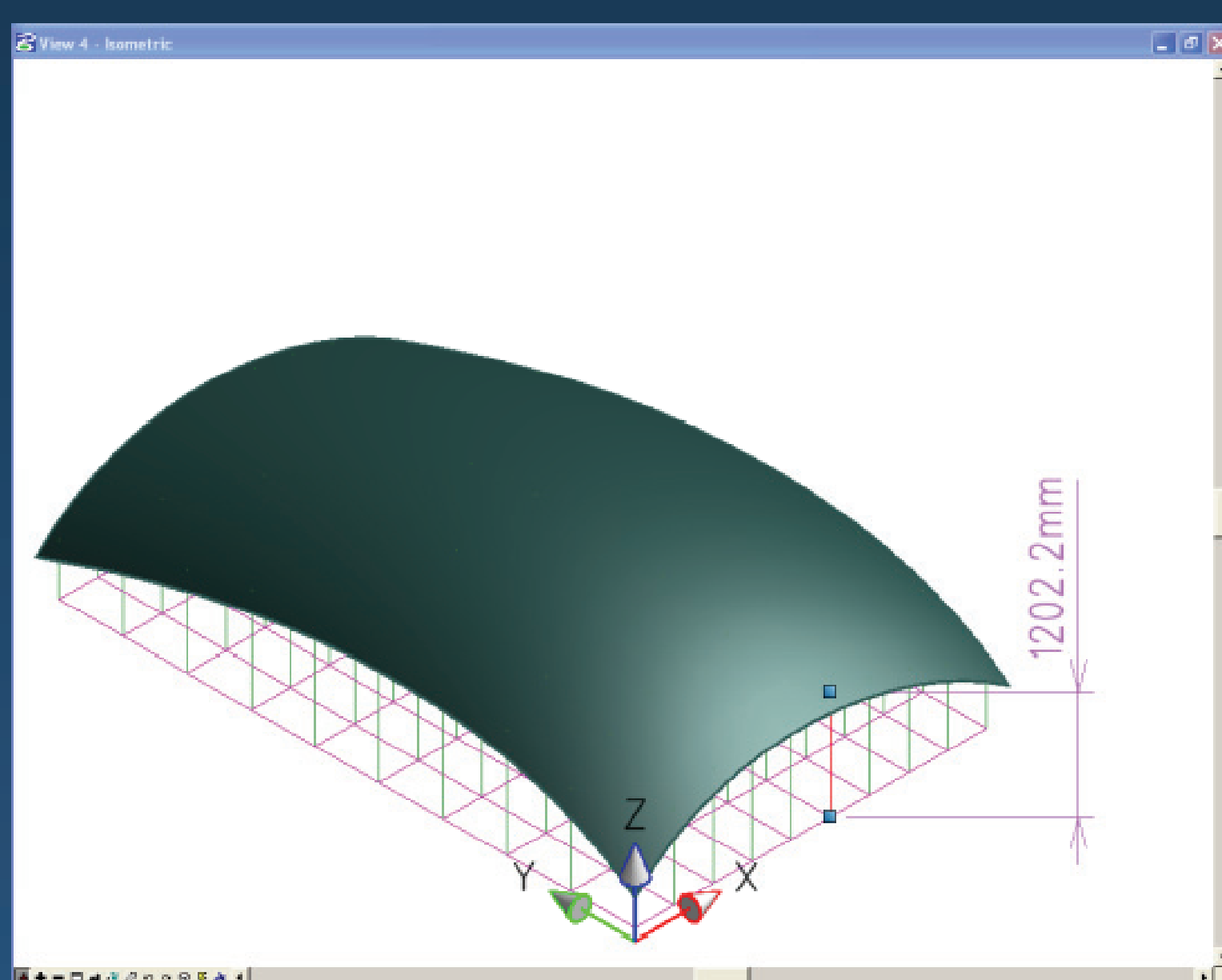
Step 4: Moving distances equivalent to 150mm. towards the interior of the surface which is projected on these axes (where the first gridded column must be placed)



Step 5: Carrying out parallel lines to the orthogonal axes, taking the distances of division of the beds of each production place (for example the Shipyard "Hijos de J. Barreras" = 1000 x 1000mm)

Step 6: Take the minimum height of the panel from the floor (example: 500mm.)

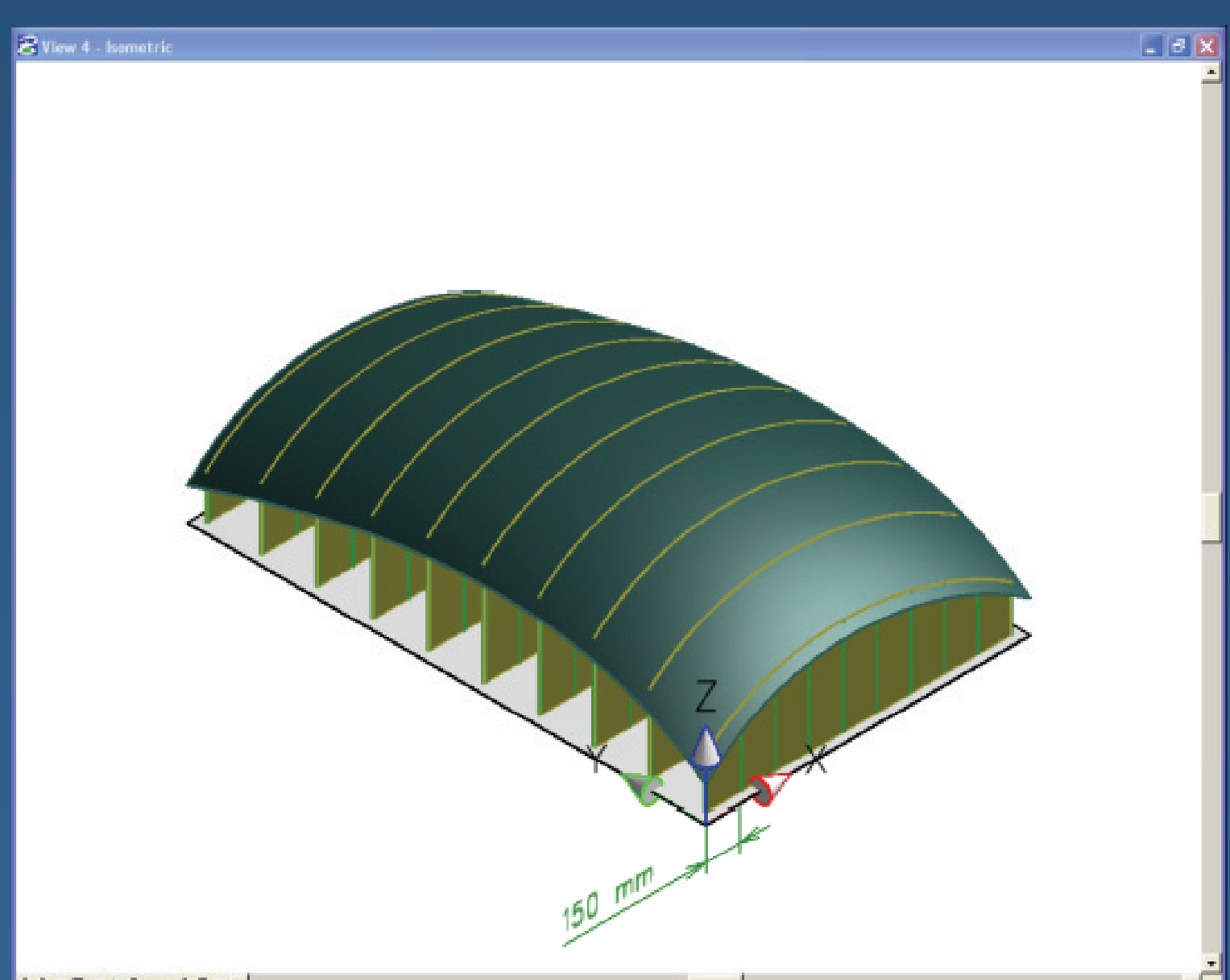
Step 7: Maximum dimensions of the bed in the factory (LxT) example of Shipyard "Hijos de J. Barreras" = 8.300x 9.746mm.



Step 8: Re-project the nodes of the orthogonal mesh upon the original 3D surface.

Step 9: Find the cutting points with the 3D surface.

Step 10: Measure the projection lines which correspond to the distances from the elevation points on the conforming bed, taking into account the minimum distance taken from the minimum height (case of Barreras 500mm). Should one of these be less, the difference must be added until 500mm. to all the rays projected.



Step 11: Obtain a report with coordinates (L,T) from the origin vertex of the surface projected, and distances in height corresponding to each gridded column (length of the projected line).

Step 12: Carry out plans which are normal and parallel to the auxiliary plan through the lines which define the frame, a vector which is common to the plate development tool.

Step 13: Cutting of the plans for the 3D surface, the resulting surfaces are the bending templates, but we need distances to be able to check.

Step 14: Measurement of the distances from the axis origin (transversal) and height.

## CONCLUSIONS

The following conclusions, among others, are significant:

Obtaining the optimum meshes for each surface. We obtain the mesh which best adjusts to each surface. In this respect, the tool allows the undertaking and visualization of the 3D mesh in order to choose what we consider to be the closest to the real surface, and, thus the best one to obtain the flat development. Fast operation: The speed of the tool is notable, given that although graphic methods may be programmed, which are used at present,[2] they would always be slower.

The definition of the finished tool: As shown throughout this project, it has been possible to develop a tool, implemented in the Integrated System of Engineering and Design, which provides enough precision in the flat undevelopable surfaces which shape the hull of the vessel, apart from giving all the necessary information for production, placement, cutting and curving.

Sole model: The undertaking of the developed plans is also significant, as it is directly generated upon the three-dimensional patches of the hull model, which is a unique sole design model to be used for calculation, analysis and manufacture, thereby preventing possible incoherence which occurs with the present system due to the lack of a sole model.



## REFERENCES:

- [1] Soto, Eva M., Leiceaga, Xoan A. and García, Secundina., "Algorithm and implementation to obtain flat development of undevelopable surfaces in industrial ship system".CMEM,2009
- [2] Enrique Pardo Trazado de líneas y desarrollos del buque. Editorial Gustavo Gili, S.A. Barcelona 1984.