Close hauled with HyperWorks – Student Team of Politecnico di Torino Sails Away from Competition

Overview

The 1001VELAcup is an initiative where students from Italian and foreign universities develop and build boats to compete in regattas. To participate in the race, the teams have to design and manufacture their own boats which have to comply with a number of special class rules: The boats for the 1001VELAcup contest cannot be longer than 4.60 m and not wider than 2.10 m. The sail of the boat has a maximum size of 33 sqm. In addition, the regulations require the use of sustainable materials such as wood and natural fibers for the hull and aluminum for the rig.

The 1001VELAcup is an excellent opportunity for universities and student teams to compete with each other. The competition allows them to compare their learning and teaching experiences, their research activities as part of naval architecture and design, and to test the innovative solutions the teams come up with under real life conditions. One of the competing teams is the PoliTo Sailing Team from the Politecnico di Torino: they developed, optimized and designed a boat made with 70% sustainable material using Altair's HyperWorks suite of computer aided engineering (CAE) tools. Even if only in its second year, the team can already show some successes. Last year the team reached an eighth position and a third position in the regatta with their supervising professor Giuliana Mattiazzo and this year they are aiming for even better results.

POLITO SAILING TEAM

"HyperWorks gave us the opportunity to find the best configuration for our structure. In particular we obtained the minimum deflection possible with the minimum weight. We are very satisfied with the outcome of our study and we know that we will be even able to improve our results in the future. In addition to the great design we created with HyperWorks, it also helped us to decrease the development time for the project"

Claudio Moscoloni,
Manager of Structural Area,
PoliTo Sailing Team

Team Profile

The team from Politecnico di Torino was founded in 2014. The team of 40 students is divided in six groups: administration, structure, fluid dynamics, public relationship, materials, and sport. Although the team is organized with a hierarchical structure and headed by a responsible manager or a team leader for each group, the individual opinion of each team member has the same weight. In addition, the team gets support from the university's mechanical and aerospace engineering department. The basic idea behind the project is that also teams of only a few students, such as the PoliTo Sailing Team, are able to handle a project such as designing, building, and sailing a skiff composed of natural materials and learn from the experience made during the project. As recyclable and eco-sustainable material is gaining importance throughout various industries, it is essential for students to know how to leverage and work with this kind of natural and composite materials – and to know how to use state of the art simulation technology which helps them to design products made of these materials.

The ATKA skiff of the PoliTo Sailing Team successfully competed in the 1001VELAcup regatta

Challenge

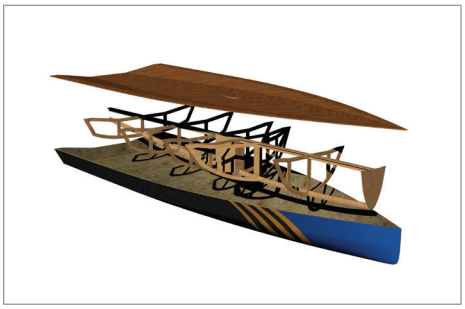
The project focused on the design and on the construction of a skiff, a particular kind of sail boat, within the given regatta regulation. The particular challenge was that the teams had to use a specific class of materials such as recyclable and natural materials, i.e. flax fiber, basalt fiber or wood. To develop a light and stiff boat structure with the given materials the team had to use sophisticated modeling and simulation tools supporting them in finding the ideal structural shape and material layout.

Solution

The team used the HyperWorks tools HyperMesh, OptiStruct and HyperView for the design and the structural analysis of a part of the skiff. A tubular structure composed of aluminum was used to support the crew.

At the beginning of the project, the students made a sketch of the boat on paper, based on the intended use cases of the skiff and the given specifications and regulations of the competition. They then created a first rough virtual model in a CAD system. After having studied the worst possible load cases that could occur, the team re-created the tubular structure in HyperMesh. In HyperMesh the geometry of the tubular structure was built with lines and a one-dimensional mesh using bar elements, since this kind of element was the most suitable for this problem. In a next step the students characterized the material properties and determined the boundary conditions such as support points and the most dangerous load cases. The load cases included one in which two crew members would be standing in the same position in the boat, applying weight to the boats structure. Although this load case is very unlikely in practice, the team wanted to be prepared for all loads that might occur to ensure the safety as well as the structural stiffness of the skiff. The students used a particular tube section and ran the analysis with OptiStruct to get first results. When initially the desired results did not occur, the team started to run a lot of different analyses, changing the dimensions of the bar section and applying different loads.

At the end of this iteration process, the students found the best configuration for their boat, combining the two preset design goals: a high structural robustness and a low weight. The project was supported by Altair Italy with documentation, software licenses, and general support via the Altair University website. In the end the team was very pleased with the developed structure showing the best performance in combination with a low weight.



Assembly view of the final structural setup

The ATKA skiff – made of 70% sustainable material

The PoliTo Sailing Team consists of 40 committed students organized in different working groups

Benefits – lighter and stiffer components for better results

The student team benefited in many ways from Altair's HyperWorks solutions. The software helped them for instance to calculate the deflection of the structure in the most accurate way possible and it enabled the students to further reduce weight and development time.

For future 1001VELAcup boats the students plan to use HyperWorks to an even greater extent to receive even better results and to explore new design strategies.

HyperWorks with its modeling and calculation tools helped the team to:

- Significantly reduce weight while increasing the stiffness.
- Save time and costs.
- Handle the requirements of the special material to find the ideal solution.

Altair Engineering, Inc., World Headquarters: 1820 E. Big Beaver Rd., Troy, MI 48083-2031 USA
Phone: +1.248.614.2400 • Fax: +1.248.614.2411 • www.altair.com • info@altair.com