case study

Altair | ProductDesign

Creactive Design

Using Optimization to Improve the Design of a Classroom

Product design consultancy and structural engineering partner, Creactive Design, wanted to explore the possibility of utilizing optimization technologies to improve the design of a cross-functional roof for an innovative new classroom environment. The classrooms, under development at architecture firm, Future Systems, would be prefabricated in glass reinforced plastic (GRP) to a high standard, making them energy efficient, durable and eminently replicable. The ambitious project was called the “World Classroom”.

solution

Creactive approached Altair ProductDesign, to assist in this explorative project due to Altair’s reputation for developing the market leading optimization software solution, OptiStruct. The team was tasked with determining where reinforcement would be needed in the roof of the classroom and which reinforcements could also double up as mechanical and electrical systems routing. The reinforcements needed to provide maximum stiffness to the overall structure while avoiding the use of excessive material.

To achieve this goal, Altair ProductDesign defined critical load cases including the weight of the roof itself along with extra loads from wind, snow and potential impact and abuse. The team used the HyperWorks suite to develop a finite element (FE) model of the classroom structure and applied the critical load cases that had been identified. The analysis process identified which areas of the classroom structure were under the most stress during the loading conditions, and suggested that the first set of bolts which hold the structure together around the curved outer rim would carry the bulk of the resulting forces. In addition, the team gave insight into where the stiffeners in the roof structure would be required to meet the performance goals.

result

Using this analysis data, the Altair ProductDesign team were able to suggest where the best locations for the mechanical and electrical systems as well as the roof ducts would be, aligning then with the with topology result to maximize the stiffness of the overall structure. Using topology optimization during the design process gave the team valuable insight into the behaviour of the structure and increase confidence that the final design would operate as intended once built.