POLYTECHNIC UNIVERISTY OF MILAN

DEPARTMENT OF MECHANICAL ENGINEERING

Carbon layers and honeycomb core for the structural innovation of a steel motorcycle-swing-arm for the MotoStudent Competition

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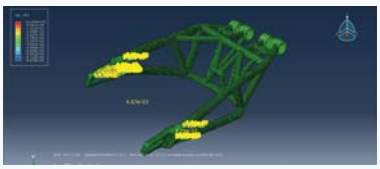
Here is presented a **research activity** to introduce **new technologies** in the component of a **motorcycle prototype** to participate to the International MotoStudent Competition .

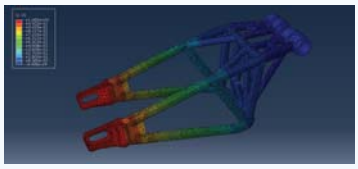
SCOPE OF THE WORK

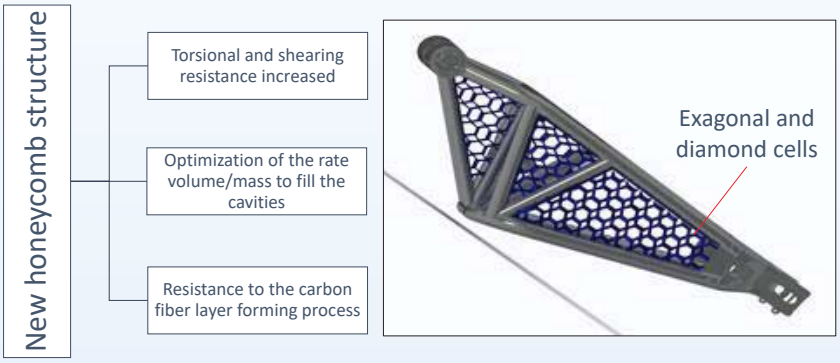
The aim of project is **improving the mechanical stiffness** of the steel **motorcycle-swing-arm** through an innovative **composite structure**. The optimal torsional, flexional and lateral stiffness of the chassis are obtained exploiting the mechanical properties of a **carbon fiber layer** added to the **steel frame**, with an inner honeycomb core as structural support. High static and dynamic performances of the vehicle are therefore guaranteed.

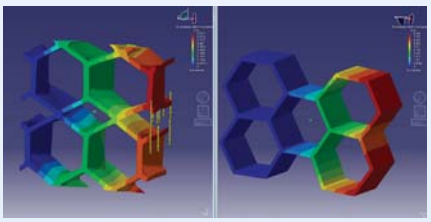
PROCEDURE

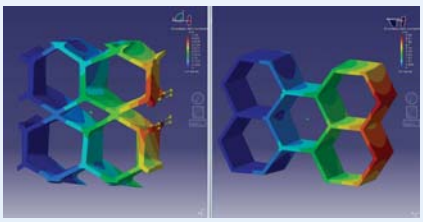
1) Design and FEM analysis of the chassis frame;
2) Study of the classical honeycomb configuration and **iterative process** to reach an innovative solution able to resist **torsional** and **shear stresses** in the diagonal direction;
3) **Reorientation** of the honeycomb structure and introduction in the cavity of the steel chassis frame, creating a **light** but **resisting support**;
4) Covering **carbon fiber layer** wrapping up the tubular and honeycomb structures.

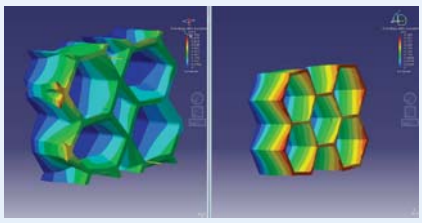












The **new honeycomb structure** has better resistance to the **torsional** and **shearing type** of l**oading**, typical of the \motorcycle swing arm, allowing its usage in the direction orthogonal to cell's axis.
The special configuration **optimizes** the **distribution** of the **mass** in the volume and provides a light **structural support** to the carbon fiber layer.
Additional **carbon fiber sheets** can be added and **oriented** according to the resisting necessities of frame.

CONCLUSIONS

The resulting **sandwich structure** is of **reduced weight** and **performances improved**. The original steel frame gains flexional, torsional and lateral stiffness guaranteeing high static and dynamic performances of the vehicle.
Compared to a whole carbon frame, the composite structure **reduces the overall costs** and **simplifies the production process**.
The simplicity of the procedure permits the **applicability** of the solution to a **wide range** of tubular **structures**.
Further developments concerns the **FEM modelling the composite material** and the **optimization** of the thickness of the honeycomb structure.