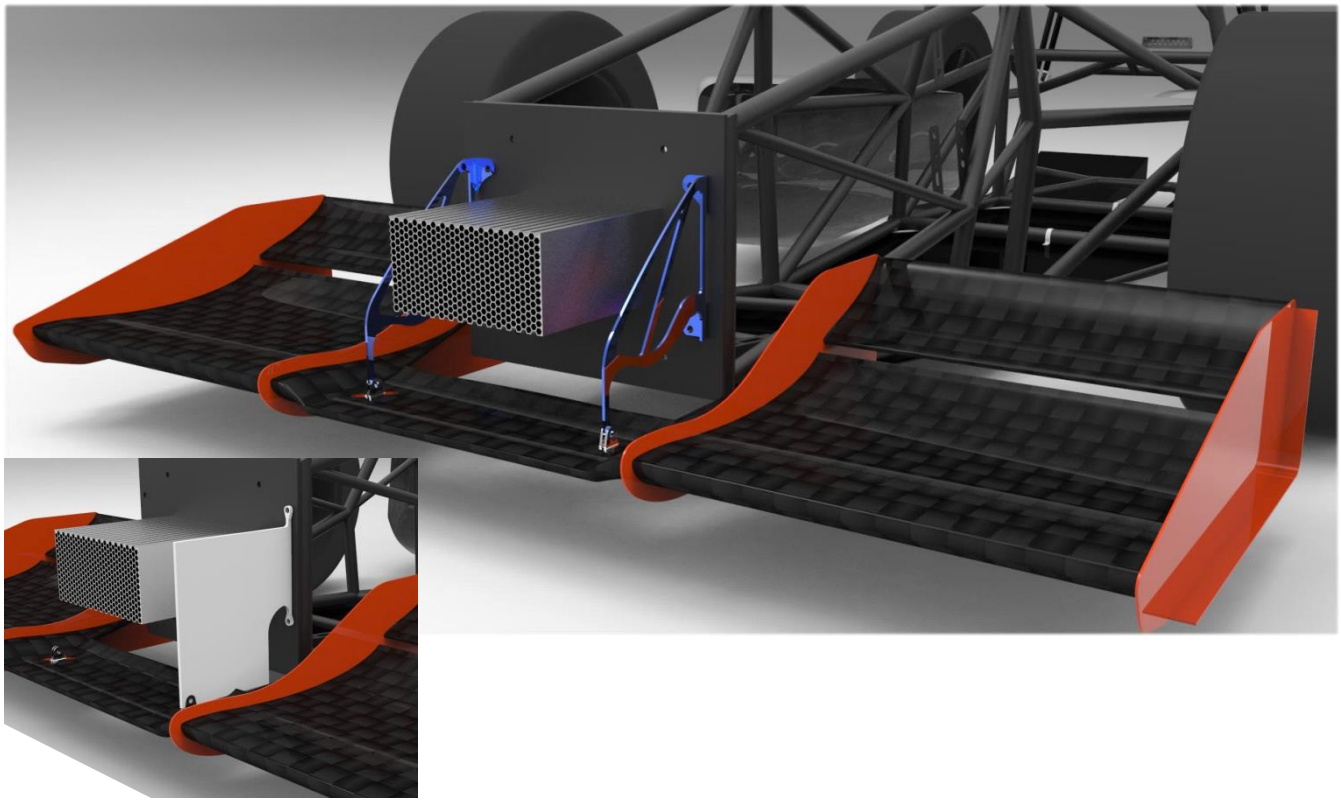
Using Generative Design to Guide the Development of a Front Wing Mount

White Paper



SUMMARY

E-Tech Racing, a Formula Student team based in the Engineering School of Barcelona, have used TruForm SW to design the front wing mount of their electric Formula Student racing car. TruForm SW is an integrated add-in for SOLIDWORKS which allows users to guide new designs, identify and resolve design issues, and reduce the mass and material cost of existing designs. This paper will demonstrate how TruForm SW can be used to develop light-weight designs in reduced timescales.

Key Topics:
– Integration at any stage in the design process
– Efficient utilisation of optimisation tools

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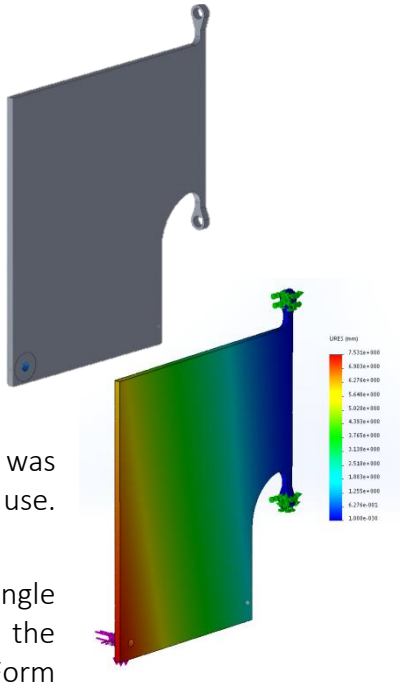
Design Space Analysis



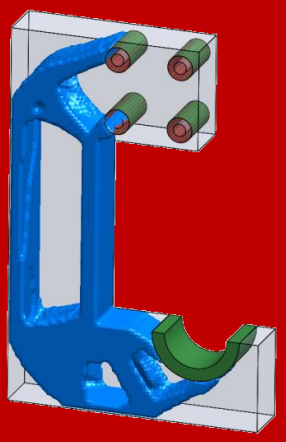
The original design space was defined with mounting points based on where the wing mount assembly would be fitted to the chassis and the wing. This design space represents the maximum possible extent of the wing mount, based on the mounting strategy and the available package allowed by the surrounding components.

Once the design space had been mapped out, a simulation study was conducted on the part based on the loads the wing would sustain in use. These included downforce and drag, as well as lateral forces.

As the front wing will experience all of these loads at the same time, a single simulation study consisting of all three loads is sufficient to analyse the structure. This simulation study will subsequently be used during the TruForm SW topology optimisation.

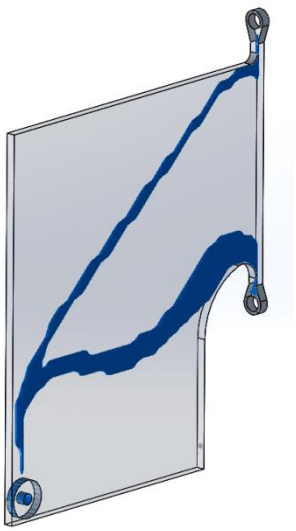
How TruForm SW Works

Topology optimisation is the mathematical study that leads to the optimisation of material within a design space based on defined loads and constraint sets. Working within SOLIDWORKS, TruForm SW allows a user to utilise the powerful topology optimisation method through a simple interface. This ultimately allows for the development of the most efficient and effective design. Saving mass, cost and time without compromise on performance.



Optimisation Results

Following confirmation of the loading using SOLIDWORKS simulation, an optimisation was carried out using TruForm SW. The design space was selected as the design region and the load and constraint set defined earlier were selected as the simulation study. The target mass was set at 20% of the original design space mass. The optimisation result shown opposite was then imported as a graphics body into SOLIDWORKS for subsequent design interpretation.



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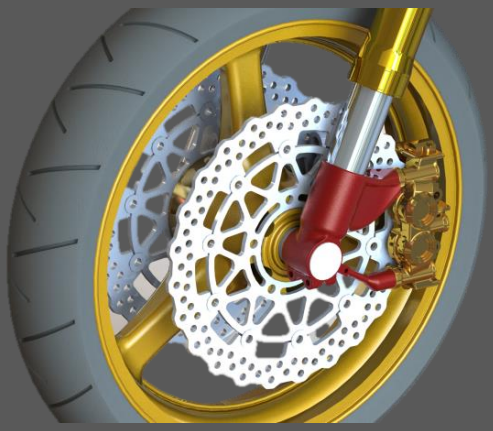
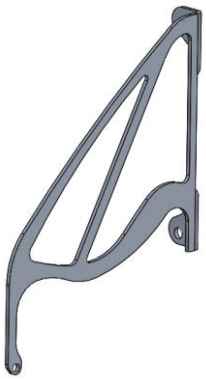
TruForm SW Xpress

TruForm SW Xpress is entirely free to download and use indefinitely, allowing you to experiment with topology optimisation and get a taste for just how powerful it can be within your existing design process.

TruForm SW Xpress is seamlessly integrated into SOLIDWORKS just like the premium version, enabling users to guide new designs, identify and resolve design issues, and reduce the mass and material cost of existing designs.



Design Interpretation



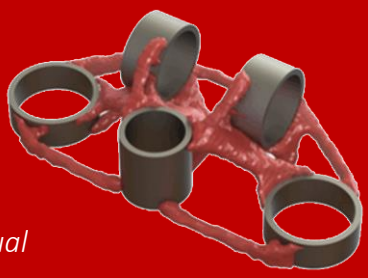
The optimisation results were then used to guide the design of the final fabricated part. The form of the optimisation was followed almost exactly although the team did decide to add an additional rib to provide further structural support.

Using TruForm SW E-Tech Racing were able to deliver a front wing mount weighing just 79g which was optimised for all the structural loads which the part would experience in use.

TruForm SW Premium

The Premium software offers advanced features including:

- *Multiple simulation study based optimisations*
- *An automated sketch tool*
- *Locally fixed or network floating license options*
- *Available as a monthly, annual or perpetual subscription.*



Conclusion

TruForm SW enabled the E-Tech racing team to develop a light-weight, cost-effective design that met all their structural requirements in a limited timeframe. TruForm SW allows users to create revolutionary designs within the familiar environment they use on a day to day basis and it can be utilised at any stage of the design process.

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