AERODYNAMIC IMPROVEMENT OF A RACING MOTORBIKE - STREAMLINING THE DESIGN PROCESS

Sabine Brosch and Paul Brandon Director of Motorsport

Kingston University

ABSTRACT

Computational fluid dynamics (CFD) has become a more accessible tool for the design engineer and can be used to help shape the development process of complex shapes and geometry such as motorbike fairings. Kingston University's Ion Horse motorcycle, which competes in the Isle of Man TTZero, is equipped with off the shelf front fairings and the application of CFD in combination with 3D scanning and polygonal modelling will help with improvements in aerodynamic performance.

The objective of this case study was to obtain a drag reduction of at least 5% in overall aerodynamic drag by improving the fairing design, internal airflows and the riding position. Additionally, the project was constrained to a time frame of 6 months and the methodology had to be economically feasible. A combination of tools have has been selected to achieve these goals within the given boundaries.

To obtain an accurate computational description of the existing fairings, geometric data in the form of point clouds were captured using photogrammetry and 3D laser scanning. These were then converted to a polygon mesh, which then had NURBS surfaces fitted using Geomagic Studio ; this data could then be exported to a conventional CAD package.

Within Solid Works multiple configurations of the motorcycle were created, featuring different variations of the fairings. Additionally, a human analogue was modelled to represent the rider in various positions. By obtaining drag figures for each of those models, a trend in aerodynamic performance was established. High-speed acceleration tests have been performed to validate discrete data points on the trend curve.

Solid Works Flow Simulation was selected to perform the numerical analysis, as its immersed body cartesian mesh algorithms and required minimal time to prepare the CAD geometry for simulation. After qualitative analysis of the pressure and velocity distribution, polygonal modelling with Autodesk Maya ® facilitated the exploration of various design modifications. The gathered data of overall aerodynamic drag and drag coefficients show that the required drag reduction has been achieved and further improvements are still possible. Currently the use of multiple software packages is unavoidable, however CAE software will be enhanced to facilitate interaction.

In conclusion, the process to achieve aerodynamic optimisation of a competition vehicle is viable for racing teams with limited resources as well as well as companies with similar constraints.

SUGGESTED THEMES

Simulation driven design, aerodynamic improvement of a competition motorcycle, 3D scanning, polygonal modelling