Cranfield Impact Centre

The Centre

The Cranfield Impact Centre is internationally respected for its expertise in vehicle crashworthiness and occupant safety analysis and design. CIC employs highly experienced professional engineers with a long list of successful projects in the areas of safety structures and occupant protection. Biomechanics is a current growth area specifically related to our pedestrian and cyclist safety projects that utilise finite element human body models.

The Cranfield Impact Centre conducts leading research with emphasis on supporting industry and government. Focusing on the end-user and life cycle interactions with the environment, our research capabilities are based on advanced technologies and tools.

What is Virtual Testing?

By “Virtual Testing”, we imply a particular innovative methodology, with computer based crash simulations as its core instrument, which combines the most enhanced modelling techniques along with quality control assessment tools and procedures, allowing for regulated, predictive and reliable evaluations. The end product is certified via analytical techniques (e.g. computer simulation) The physical event may be a full scale vehicle crash, or a component static test, such as an airbag or a vehicle bumper striking a pedestrian.

What is the difference between Virtual Testing and Modelling?

VT sets itself apart from just modelling or computer simulations, by understanding the reliability and robustness of the results, taking into account the variability of a physical event and incorporating that data into the model. If you perform one simulation of an event there is limited confidence or reliability in the model. VT is a comprehensive and robust methodology tool, performed which captures the variability of a physical event without the need to perform numerous physical tests.

How is Virtual Testing Conducted?

The standard method of performing modelling is to use a Finite Element software package . This method is used by VT only as an initial step. The method is repeated to obtain a more comprehensive assessment using statistically proven technologies. Most physical events have a stochastic or random element to them, which is not defined by a single result

Why do you need Virtual Testing?

- Do you want to understand what happens to your component, structure or vehicle in a real event before it occurs?
- Do you want to obtain an understanding before the first prototype has been built?
- Do you want to gain greater confidence in your modelling activities?

If you need to identify potential failure issues, with the design and manufacture of a component. VT offers the opportunity to identify those failures at the earliest possible stage without the need to build an expensive prototype and to test it to destruction.

Innovative companies who are designing structures to tight schedules do not always have access to high performance computing facilities or the necessary expertise in finite element procedures. VT can provide guidance

Two Methods of VT

Surface Response Method

This method is essentially based on a spatial extrapolation of validated results, obtained at an initial set of qualified control points. It assumes that if, at the regulated control points, the model predicts closely enough the danger zones and is comparable to known physical results, and if the corresponding threshold criteria values are also closely matched (i.e. both x and f(x)), it then has the capability of identifying (via extrapolation) other vehicle specific critical points. Thus contributing to their removal via the introduction and verification of structural modifications.

3R Method – Rating, Reliability, Robustness

This method is based on the observation that whatever the predictive capabilities of simulation tools may be, the validity of the prediction needs to be demonstrated either by “clustering” a large number of simulations with the objective of predicting the same phenomena but with different starting points, or via an adapted experimental validation. Note that the experimental approach is not aimed at validating the vehicle, but the numerical prediction of the response of the vehicle subject to a given impact loading situation.

What CIC can offer?

- High Performance Computer Facilities
- Pre-Processor software, including Hyperworks, IDEAS
- FE software codes, PamCrash, LS-DYNA, Radioss
- Post Processing software, including ModeFrontier, ADVISER
- Engineers with over 20 years experience in using VT
- Conversion of Models between software codes
- Projects can be performed on or off site.

The CIC VT solution

A typical programme of work will consist of three distinct stages.

The Formulation of Work Programme Stage

The Creation and Solving of the Initial Model

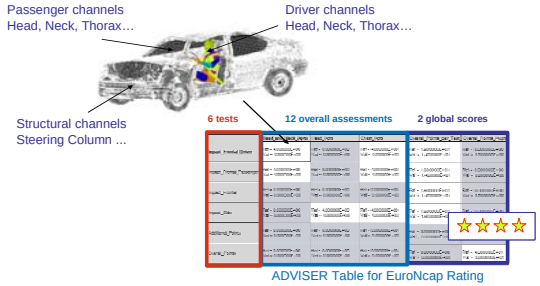
The Virtual Testing Stage Surface Response or 3R method

At the end of the project what will you have gained?

- A greater understanding of the performance of your structure which could not be achieved by modelling and generating a single answer.
- Confidence to use the model for future design changes, as the model is robust and reliable.
- Expertise in best modelling practise for VT
- The ability to use the models to assess for potential future legislation changes

A typical VT example for a EuroNCAP Procedure.

The EuroNCAP **ADVISER template** provides a complete implementation of the EuroNCAP rating protocol, allowing for automatic evaluation of the scores and star rating.



ADVISER Table for EuroNcap Rating

EuroNCAP Template Results

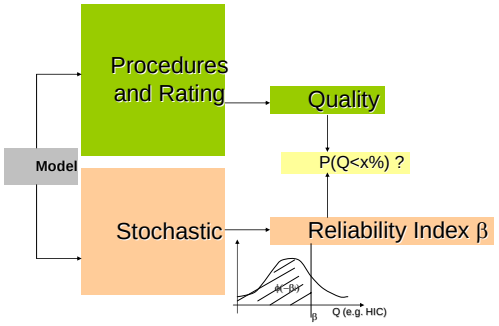
Frontal Driver

Head and Neck	0 pts
Chest	2.11 pts
Knee, Femur and Pelvis	0 pts
Lower leg, Foot and Ankle	0 pts
Door Opening (-1 each door)	0 pts
Overall Front	**2.11 pts**

4 pts
2.67-3.99 pts
1.33-2.66 pts
0.01-1.32 pts
0 pt

Side Impact

Head	4 pts
Chest	1.67 pts
Abdomen	4 pts
Pelvis	4 pts
Door Opening (-1 each door)	0 pts
Overall Side	**13.67 pts**



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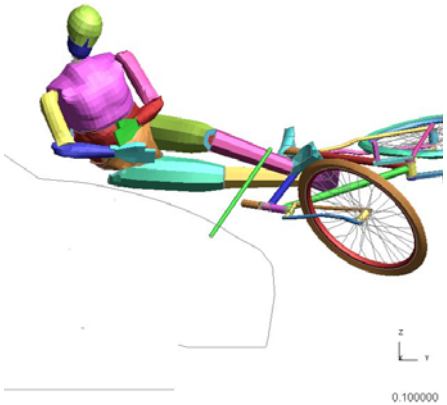

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