

Reverse Engineering In Action

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Whether it's repairing a kitchen appliance or rebuilding a car engine, people can learn many things about a product by simply taking it apart and putting it back together again. In essence this is the concept behind Reverse Engineering. It's about taking an object apart to see how it works, in order to either copy or improve the design.

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Many manufacturing companies such as Jaguar also use Reverse Engineering in 'live design and manufacture applications' to improve existing car design, or to develop new products to compete within a highly competitive international market place.

Now that Design and Technology students have ready access to Computer Aided Design (CAD) software, Reverse Engineering allows them to create a 3D virtual model of an existing physical part for use within a 3D CAD/CAM software package.

A Reverse Engineering process involves measuring a physical object and then reconstructing it as a 3D model. The physical object can be measured using 3D Laser Scanning technology, either from a determined angle or through partial/full 360 degree rotation, when used in conjunction with a rotary fixture.

Denford Ltd has recently produced a full colour A2 poster which explains the Reverse Engineering process by developing a project which is based on an actual Reverse Engineering application using a 3D laser scanning head, a rotary fixture and a Denford CNC Router 2600. The poster takes the student through a 6 stage process:

1. Select a model.

Often, products may be a complicated shape, where traditional measuring techniques using rulers, micrometers, depth gauges and vernier callipers etc. is challenging, time consuming and often impossible, therefore traditional CAD input is not a viable option. Where a prototype has been modelled (in clay for example), there is no guarantee that a CAD drawing will be acceptably close to the sculpted model. Reverse Engineering provides a solution to these problems, because the physical model is the source of the information for the CAD model – this is sometimes referred to as the "Part to CAD" process.

2. Scan the model

The physical model is scanned using a 3D laser scanning head. The measured data is represented as a Point Cloud. In computer science, a Point Cloud is a set of 3 Dimensional points describing the outlines or surface features of an object.

3. View the image

The Point Cloud is used to create a virtual model, which can be manipulated to the required specification. For example, it could be scaled up or down to produce a larger or smaller product than the original. The data can then be transferred to a CAM (Computer Aided Manufacture) system to create a CNC (Computer Numerical Control) code.

4. Manufacture

The CNC code is used in conjunction with a CNC machine to manufacture the model. The CNC code is a series of lines containing important information which tells the machine which co-ordinates (X,Y, Z position) it is required to move to and when to activate the relevant auxiliary functions, such as spindle start/stop and tool changes etc. Where complex designs have been created, the CNC program may be thousands of lines long.

5. Completed model

Reverse Engineering assists manufacturers and designers to meet the demands of reduced product development times. As a result, they can get products to market quickly and effectively.

6. Completed car

The design can be produced on a variety of manufacturing machines, including a Denford CNC Router. The images on

the Denford poster demonstrate a Reverse Engineering application, emulating a real life process which engineers in automotive companies such as Jaguar follow, i.e. sketching, modelling, scanning, analysing, making, testing and racing.

This particular Reverse Engineering project can be used to provide students with links to STEM activities by exploring the interconnection between the subjects of science, technology, engineering and mathematics.

Denford Ltd and Jaguar have worked in partnership to introduce the "GT in Schools" - the Sports Car Challenge. The competition is open to all UK based Secondary Schools, Colleges and (organised) Youth groups, to use Reverse Engineering principles to design and manufacture CO2 powered, model GT sports cars. Teams of Students compete against each other in regional and national championships to determine the best designed and engineered sports car in the UK. It is just like being in a real automotive design and engineering team. For more information visit www.gtinschools.com

For a free copy of Denford's 'Reverse Engineering in Action' poster, please contact us..