Clocking on (2)

Enhancing CAD through educa

In the last issue of DATA Practice we followed students from Langley School as they developed clock designs using Pro/DESKTOP and SolidWorks, and tested the strength of the designs with both Finite Element Analysis and using weights in a Science lesson. Once the designs had been finalised the students visited one of the school's industrial sponsors, NTCADCAM to learn more about rapid prototyping and to make use of the equipment there, before going on to completing their clock designs.

Rapid Prototyping standard format

The CAD model data is converted into the STL file format through a translator. The STL file is a standard format of Rapid Prototyping systems developed by 3D Systems who pioneered commercial Stereolithography apparatus in 1987. The STL file consists of x,y,z co-ordinates which represent triangles describing the shape of a closed 3-D CAD model. A concern with the STL format involves the representation of curved surfaces. Some CAD packages are less accurate than others when converting data into STL format for use with RP (rapid prototyping) machines. SolidWorks allows the user to select the size of STL file based on accuracy of triangles.

Industrial visit to NTCADCAM

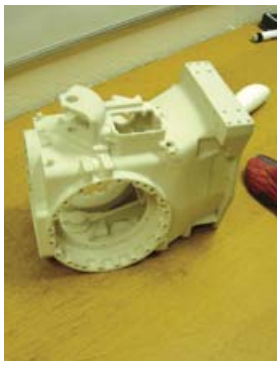
The students visited New Technology CADCAM Limited (NTCADCAM), one of our industrial sponsors, to make use of their three dimensional rapid prototype machine. The machine uses a process called 'Fused Deposition Modelling' (FDM), which builds up a model by the deposition of two molten structures of material onto a base plate, one of which is a support structure and the other the actual part or assembly. Solidification is completed by cooling of the molten material on the colder underlying layers. The molten material is taken from a solid filament of thermoplastic material, and it is fed into a XY controlled extrusion head at 1°C above melting temperature. In this way, re-solidification is ensured by natural cooling within 0.1 seconds. This technique can achieve overall tolerances of 0.125 millimetres, causing some parts to seem rather rough and making the process less suited for objects with small details. The FDM technique allows building up parts from different materials such as investment casting wax, wax-filled plastic adhesive material, and tough nylon like filament; and applying different colours as well.

tion and industry partnerships

3-Dimensional RP Machine.

Student Kristen Gratze designing the clock hands for Rapid Prototyping.

Other models that students discovered at NTCADCAM included the following:



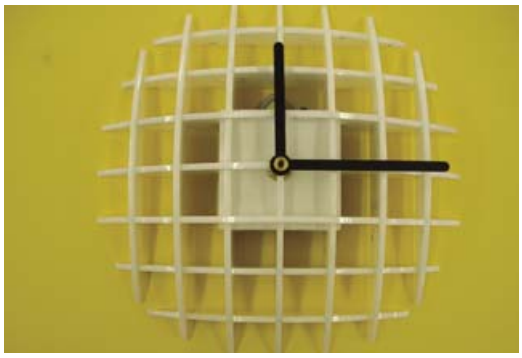
Models above include: sheet metal work for the truck, starch printing for the axle casing and shoe, stereolithography (resin) for the dog lead casing and FDM for the dinosaur.

Due to the amount of time it can take to rapid prototype the clock model the team were developing NTCADCAM systems had two models ready for us upon arrival on the day of the visit. We had used the remote manufacturing link between the school and NTCADCAM to send all the CAD information to the company prior to the visit. This is because we would not have time on the day of the visit to manufacture two complete models as the RP time would have been about 20 hours. Two models were made so the Board of Directors were able to assess the complete assembly and how well the model can be assembled. On the day of the visit the students designed a unique set of clock hands to display on our 'Industry Day' where the clock and prototype models were also shown to our industrial sponsors along with other projects that students have produced. This is also a good opportunity to arrange new design problems for the following academic year.

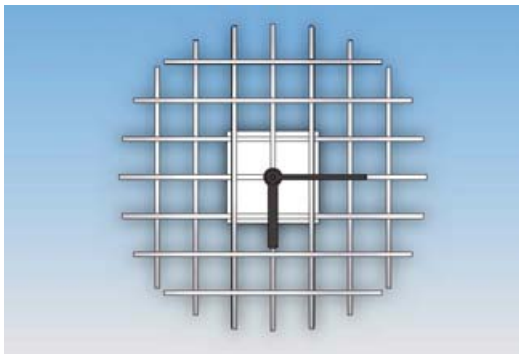
Model 2 – a solid assembly.

Model 1 – separate parts which can be assembled by the customer.

Model clock hands designed and rapid prototyped by students on the day of the visit.

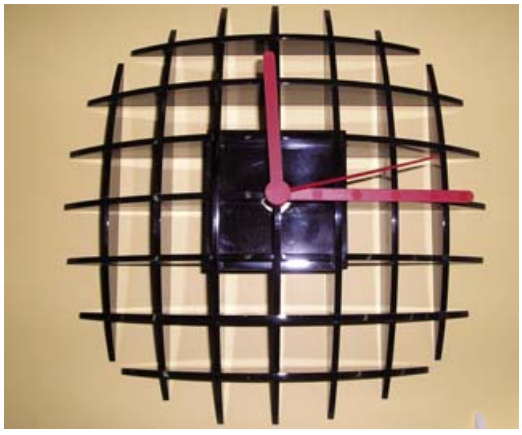


Finished product in white.



CAD design in white.

CAD design in black (Isometric).



Finished product in black.

Evaluation

The clock was presented for evaluation to the Board of Directors (other design and technology teachers in the department and NTCADCAM). The feedback was very positive with the agreement that the finished product would be good enough in its current form to be included in the current product range. The prototype models enabled the board to construct the clock quickly and assess its potential as a product for a teenager. NTCADCAM thought the clock was well designed and manufactured using extensive use of CAD/CAM and promoting an awareness of some of the design problems faced by product designers. They also thought that the clock would make an excellent 'loyalty' product for companies to send to their clients, and the clients get the challenge of putting it together!

Success for me quite simply means that the clock is now positioned on the wall in the Design and Technology department and used as a source of inspirational design for students next year. A school clock design was also made to present to the Headmaster in the school colours. The team of students will also receive an award at the industry day for 'Innovation in manufacturing' – manufacturing a product using industrial process (Rapid Prototype machine).

Langley School would like to thank our industrial sponsor, New Technology CADCAM Limited for their support with this project.