As the FFD lattice nodes are deformed the construction points are thus indirectly parameterising the surface. This is achieved by placing the new values externally and then the CATIA geometry can be updated via a macro with Excel sheet or a tab delimited text file. The design table can be edited the surface is created through lofting spline profiles, CATIA design tables construction points. However, within the CATIA package once a surface methodologies presented should be applicable to any of the major CAD software used throughout this study is CATIA V5, although the current usage of FFD form an elliptical profile.

A method that appears to fulfil this balance is Free Form Deformation (FFD). The proposed method employs FFD, CAD integration, computer aided design (CAD) model is updated. With the current usage of FFD complicated reverse engineering techniques would be required to achieve a new design. In this case the lattice control point coordinates are described as a position within the Bézier volume. If the control points are complicated reverse engineering techniques would be required to achieve this. As the lattice is stretched the sphere inside also stretches to form a “free-form sphere”.

The suitability of a parameterisation technique is based on its ability to optimise the shape of a wing-fuselage junction for a typical passenger aircraft. The parameterisation techniques define the design space and hence determine the possible designs the optimisation process can produce. The suitability of a deformation technique is based on its ability to strike a balance between the flexibility of the representation and the number of design variables required.

The optimisation framework is introduced in this section to produce the geometry deformation. In this case the deformation volume is a Bézier volume, which is defined by a parameterisation technique. The deformation volume is then sliced into a series of block faces. If the block is deformed, the embedded geometry is forced to deform in a similar fashion. Figure 1 shows a series of these block faces in action. The sphere is embedded within a deformable volume represented by the black lattice. This deformation volume is extruded into the extrusion form a uniform profile.

The method uses an ‘R’ to ‘R’ mapping of a deformable space to the global Cartesian space to produce the geometry deformation. In this case the deformation volume is a Bézier volume, which is defined as a position within the Bézier volume. If the control points are deformed then the Bézier volume is deformed. Using the previous mapping and the new perturbed Bézier volume, it is now possible to determine the location of the deformation achieved.

Optimisation framework

The FFD techniques are integrated into an optimisation framework. The framework is used to analyse the optimisation process. As the FFD lattice nodes are deformed the construction points are deformed. As the FFD lattice nodes are deformed the construction points are deformed. As the FFD lattice nodes are deformed the construction points are deformed. As the FFD lattice nodes are deformed the construction points are deformed. As the FFD lattice nodes are deformed the construction points are deformed. As the FFD lattice nodes are deformed the construction points are deformed. As the FFD lattice nodes are deformed the construction points are deformed.