COMPUTER AIDED MODELLING
OF
SHEET METAL FORMING

By

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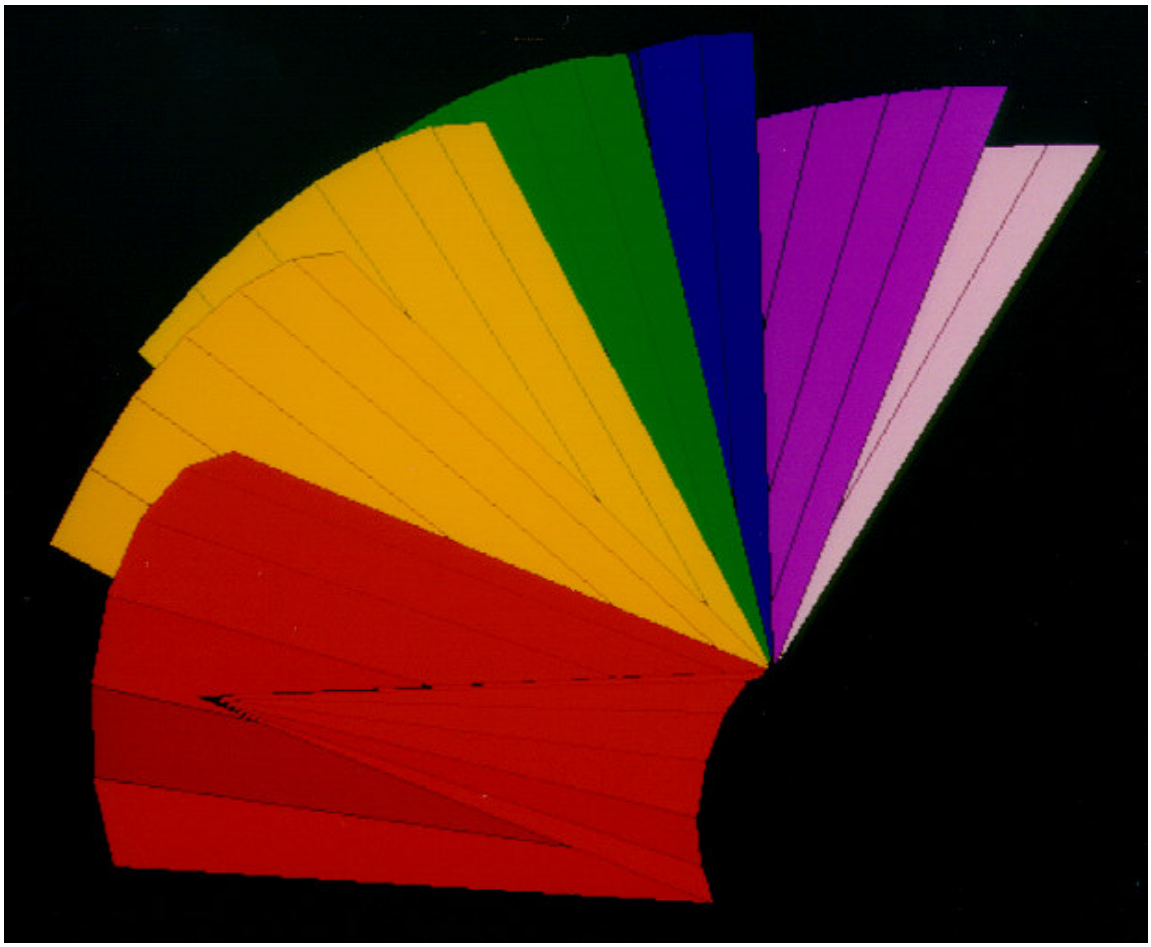
TO LEEANNE



ABSTRACT

The work described by this thesis presents several new methods of the computer modelling of sheet metal forming. In particular it focuses on the design steps of sheet metal forming; blank shape prediction, part design, die design and part applications.

This work concentrates on developable surfaces, which are the tangent surfaces of space curves and include cones and cylinders. Developable surfaces are so called, because they can be rolled out (developed) onto a plane without stretching, tearing or creasing. A folded developable is formed when a developable surface is folded about a curve. Since folded developables are formed only by folding they are ideally suited to being constructed from sheet metal.

New theories are presented that accurately predict the surface that will be formed if a general developable surface is folded about a general curve. The theories have been developed into a computer program, 3FD, that allows the rapid and accurate design of folded developables. Several different folded developables have been designed using the program and compared with physical results, with excellent geometric correlation.

An improved method of computer aided blank shape prediction has been developed. The method can be applied to both folded developables and to general sheet metal components. The method uses new boundary conditions to increase the accuracy of the predicted blank shape. The method also indicates possible areas of forming problems. A pressed automobile component is used to illustrate the increased accuracy of the new method.

The design program can also generate the geometry necessary to create the die set to form a folded developable. Such a die set has been created and a folded developable formed from it. The formed folded developable closely matches the computational model.

The design program has also been used to investigate the kinematics of folded developables. The mechanism of a simple folded developable has been determined and the implications and possible applications of this are discussed.

Frontispiece: Multiple images of conical folded developable. The coloured images show the surfaces formed by changing the initial surface radius of curvature from 0.1 (red) to 1 (violet). The folding curve geodesic radius of curvature remains constant at 0.5.

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