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Modelling Complex 3-D Salt Body Geometry Using Alpha Shapes

Accurate modelling of salt body architecture presents unique difficulties in model building owing to the complex geometry of point data obtained from interpretation of 3-D seismic data. Modern algorithms for automatic surface construction can reduce model risk.

We present an approach founded on the concept of the “alpha shape” -- a linear approximation of the original shape. The concept of alpha-shapes formalises the intuitive notion of “shape” for spatial point set data, allowing reconstruction and visualisation of the original structure.

User variation of a sensitive parameter “alpha” results in a family of shapes capturing the notion of crude to fine interpretation of the point data. Sufficiently large values of alpha result in the convex hull of the point data, whereas sufficiently small alpha vales result in an empty shape. The geometries defined by intermediate values of alpha need not be convex surfaces, or indeed single entities, making this method ideal for automatically building geologically realistic geometric models of intricate shapes including salt bodies, tightly folded surfaces or ore bodies, whilst retaining a degree of user control.

Furthermore, in contrast to other concepts used in geometric modelling of geologic surfaces, the alpha shape is a concrete geometric object that is uniquely defined.