A grid mapping algorithm for modeling with geometric transforms

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Highlights

- **Geometric transformation workflows for tabular deposit modeling are reviewed.**
- **The output model is a structured grid that must be mapped to a regular grid.**
- **A new method is proposed for improving the speed and precision of this mapping.**
- **The method is demonstrated using a tabular nickel sulphide vein deposit.**

Abstract

The geometries of subsurface deposits are often discordant with the geodetic coordinate system in which drilling, engineering design and operations are performed. To provide superior characterization of a deposit with computational advantages, a common workflow begins by modeling the deposit's geometries, before transforming property data into a local coordinate system.

Within this system, the property data is flattened with respect to a regular rectilinear grid, facilitating the effective use of conventional geostatistical modeling algorithms. After back-transforming to a geodetic coordinate system, the gridded model values will not align with the original system. Depending on the nature of the transform, the model values may be converted from a regular grid in local coordinates to a structured grid in geodetic coordinates, where the incremental spacing and shapes of cells are irregular.

Most model applications require a regular grid as input, such as within mine planning software and many flow simulators; the structured grid values must therefore be mapped to a regular grid. Practical but sub-optimal methods, such as nearest neighbour, are often used in practice for this mapping.

A new method, termed Structured to Regular Grid Mapping (SRGM), is proposed as an alternative. Through the combined use of grid pre-screening, point-in-tetrahedra testing, and sequential planar tests, SRGM provides substantially improved precision and reduced computational expense relative to the nearest neighbour approach. SRGM is introduced with a small example, before demonstrating it with a tabular nickel sulphide deposit.

Practical considerations and limitations of SRGM are also discussed.