I've created a comprehensive 3D geological domain modeling system with structural controls and boundaries. Here's what I've implemented:

## Key Features

### 1. \*\*Geological Domain Types\*\*

- \*\*Lithological domains\*\*: Rock type classifications with mineral composition

- \*\*Alteration domains\*\*: Hydrothermal and metamorphic alteration zones

- \*\*Mineralization domains\*\*: Ore zones with grade statistics and paragenesis

- \*\*Structural domains\*\*: Deformation zones and fabric analysis

- \*\*Geochemical/Geophysical domains\*\*: Anomaly zones and signatures

### 2. \*\*Structural Controls\*\*

- \*\*Faults\*\*: With displacement, kinematics, and movement sense

- \*\*Folds\*\*: Axial traces, plunge, and fold geometry

- \*\*Contacts\*\*: Conformable, unconformable, and intrusive contacts

- \*\*Veins/Dikes\*\*: Orientation and geometric properties

- \*\*Fractures/Joints\*\*: Spacing and orientation data

### 3. \*\*3D Wireframe Generation\*\*

- \*\*Multiple algorithms\*\*: Convex hull, alpha shapes, Delaunay triangulation

- \*\*Data sources\*\*: Drill holes, block models, interpretation points

- \*\*Quality metrics\*\*: Topology validation, smoothness, completeness

- \*\*Export formats\*\*: GOCAD, OBJ, PLY, JSON

### 4. \*\*Domain Analysis Tools\*\*

- \*\*Intersection analysis\*\*: Volume calculations between domains

- \*\*Continuity analysis\*\*: Spatial, grade, and structural continuity

- \*\*Validation system\*\*: Geometric, geological, statistical validation

- \*\*Confidence assessment\*\*: Multi-criteria confidence scoring

### 5. \*\*3D Visualization\*\*

- \*\*Interactive viewer\*\*: Pan, zoom, rotate, select domains

- \*\*Rendering modes\*\*: Solid, wireframe, transparent

- \*\*Color coding\*\*: By type, confidence, volume, age

- \*\*Structural overlays\*\*: Constraints, measurements, labels

### 6. \*\*Advanced Features\*\*

- \*\*Hierarchical domains\*\*: Parent-child relationships

- \*\*Temporal constraints\*\*: Relative and absolute timing

- \*\*Paragenetic sequences\*\*: Mineral deposition stages

- \*\*Grade continuity\*\*: Spatial correlation analysis

- \*\*Export/Import\*\*: Multiple industry-standard formats

## Usage Examples

1. \*\*Create lithological domains\*\* from drill hole intersections

2. \*\*Define structural constraints\*\* like faults and folds

3. \*\*Generate wireframes\*\* using various algorithms

4. \*\*Validate domain geometry\*\* and geological consistency

5. \*\*Analyze domain intersections\*\* for resource estimation

6. \*\*Export models\*\* for mine planning software

The system provides a complete workflow for geological domain modeling with professional-grade tools for structural geology, resource estimation, and 3D visualization.

I'll implement comprehensive stereonet analysis, rose diagrams, and structural statistics tools for the geological domain system.

I've implemented a comprehensive structural analysis system with stereonet analysis, rose diagrams, and structural statistics. Here's what I've created:

## Key Features

### 1. \*\*Stereonet Analysis\*\*

- \*\*Multiple Projections\*\*: Equal-area (Schmidt), equal-angle (Wulff), and orthographic

- \*\*Interactive Canvas\*\*: Click to select measurements, zoom, and pan

- \*\*Statistical Analysis\*\*: Mean vectors, confidence ellipses, Fisher statistics

- \*\*Contour Analysis\*\*: Density contours with customizable levels

- \*\*Cluster Detection\*\*: Automatic identification of data clusters

### 2. \*\*Rose Diagram Analysis\*\*

- \*\*Multiple Types\*\*: Frequency, length-weighted, area-weighted, bidirectional

- \*\*Customizable Bins\*\*: 5° to 45° bin sizes

- \*\*Statistical Tests\*\*: Rayleigh, Kuiper, and Watson uniformity tests

- \*\*Preferred Orientations\*\*: Automatic detection of dominant directions

- \*\*Interactive Selection\*\*: Click bins to explore data

### 3. \*\*Structural Statistics\*\*

- \*\*Comprehensive Analysis\*\*: Planar and linear data statistics

- \*\*Orientation Tensors\*\*: Eigenvalue analysis and fabric classification

- \*\*Fabric Strength\*\*: S, L, LS, SL fabric types with development stages

- \*\*Dispersion Analysis\*\*: Standard deviation, variance, confidence intervals

- \*\*Histogram Analysis\*\*: Dip and plunge distributions

### 4. \*\*Advanced Features\*\*

- \*\*Data Filtering\*\*: By type, quality, confidence, and domain

- \*\*Multiple Visualizations\*\*: Simultaneous stereonet, rose, and statistics views

- \*\*Export Capabilities\*\*: PNG, SVG, and JSON export options

- \*\*Sample Data\*\*: Automatically generates realistic geological measurements

- \*\*Real-time Updates\*\*: All views update dynamically with filter changes

### 5. \*\*Professional Tools\*\*

- \*\*Measurement Management\*\*: Add, edit, and organize structural data

- \*\*Quality Assessment\*\*: Data quality and confidence tracking

- \*\*Domain Analysis\*\*: Structural domain classification and comparison

- \*\*Relationship Analysis\*\*: Intersection lineations and angular relationships

The system provides professional-grade structural analysis tools commonly used in geological and mining applications, with interactive visualizations and comprehensive statistical analysis capabilities.