Trispace

1 Introduction

1.1 Trispace

Defines and elaborates on more layered surfaces. It offers the possibility to obtain autonomous triangulations of each layer, which can subsequently be put into relation with them to calculate volume, offsets, excavations, etc.
It also offers 3D viewing of single surveys or complete layers, and axis selection on a visual plane(X,Y,Z).
It provides the insertion of point coordinates from the keyboard, with the possibility to indicate additional attributes, such as the symbol, the colour, if it is a detailed generic point, a fiducial/station point or penetrometric drilling.
In the latter case, it is possible to specify more depth quote for the same planimetric coordinate.
Trispace also makes it possible to import survey points from different formatted files: Autocad, DXF, formatted texts, excel.
It also offers standard graphic objects, such as texts, lines, polylines, archs, polygons, and rectangles.
Other important features are:

- Duplicate analyses;
- Guided point decimation;
- Standard precision tools (SNAPs and guild grids);
- Importation of scaled bitmap images(raster graphics);
- ASCII importation with general formats.

1.2 Triangulations/Surfaces

- Point triangulation with the possibility to indicate resistance lines, perimeters, or excluded areas(for lakes,ditches, etc);
- Automatic triangulation of survey points' movement;
- The obtainment of a contour line with personalized labelling;
- Wide choice of colouring shades to highlight the layer quote.

1.3 Interpolations

- The obtainment of Isozone;
- An editable Voronoi diagram;
- Kriging;
- Linear and cubic interpolation (using estimations and approximations);
- Levellings with a horizontal plane;
- Levelling with a plane through three points;

- Levelling between two surveys;
- Excavation simulations;
- It is possible to define buildings in 3D.

1.4 Sections

- Longitudinal section is directly on a arbitrary polyline base;
- Longitudinal section for point combination;
- Automatic equidistant sections;
- Tridimensional section with interpolation of more surveys with different quote.

2 Calculation and control tools summary

2.1 Quota Exchange

This allows the quota modification of all the survey points, based on a variation of a known point.

2.2 Coordinate Inversion

This allows the coordinates to be inverted in relation to a known axis and the distance from the axis.

2.3 Verify Constraints

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Once the constraints are inserted into the survey, this function then allows the possibility to first determine the validity in order to perform the final triangulation. The constraints' application rules entail other criterias:

- No line can intersect another;
- There shouldn t be any double lines;
- The lines can have coincidental vertices on the survey points, but they can t have aligned points on the same line.

2.4 Capture triangular points

This function draws possible new points derived from triangulations, refinements, interpolation. The new points capture completely substitutes the original set. All of the obtained data is a "detailed" type and is associated with the "Points" layer.

2.5 Distance

This allows the drawing of a temporary polyline to verify the progressive distances, totals, planimetrics and 3D.

2.6 Duplicate points control

This allows the verification of double points if they are present on survey. The tolerance value is specified in the section control panel. "Survey points" ->"Double points tolerance". The window will cause a display result which will show individual points as double points. Although possible, It is wisely recommended that you not run triangulations when double points are present.

2.7 Double points decimation

As in the previous function, with the dfference that it deletes them from the survey. There are two calculation modes: Leaving the first individual point or running the average, personalizable from the control panel section " Survey points" ->"Decimation mode".

2.8 Offset

Running the offset(equidistant) of a polyline or a polygon. The offset value (indicated in the input window) applied to a polyline produces a polygon with a thickness equal to the specified offset. Applied to a polygon keeping another polygon around the same offset thickness.

2.9 Add node

Add node and a polyline or polygon to the position indicated by the mouse

2.10 Remove node

Delete a polyline or a polygon vertex.

2.11 3D Plane Alignment

Consists in the calculation of the of the survey points quota from the average plane. For example, we know that it is a surveyed plane(horizontal or inclined),and this function allows you to graphically verify the possible imperfect measurement. In the 3D preview window displayed in the calculated plane, the split in blue highlights the positive quote and the red one highlights the negative quote. At the end of the process, the program ask if you would like to save the results on the current survey. This option should allow, a once duplicate of the original survey., to compare the differences between the due numerical models(with the Compare measurements), to calculate the excavation and report(use the intersection function between the two DTM)

Algorithm use:

- *Least squares;*
- *best fit plane check.*

2.12 Compare measurements

This functions allows the verification of two numerical models highlighted in the tolerance discard, being on a data grid(exportable or printable) graphically .

See also: *3D plane alignment*

2.13 Convert Isolines -> Polylines

The isolines o curve of the survey produced by the programme are not modifiable by the user as a simple polyline, and they are associated exclusively to the current DTM. This

functions allows the conversion of the isolines into normal polylines. At this point it is possible to control the graphic characteristic or the geometrical data, and their visibility will extend to all the DTM in the project.

2.14 Mouse click on survey points

Constrains the insertion of nodes(for example, a polyline)on survey points. It is useful in defining the constraints, which do not allow the indicating of vertices that are not coincidental to points.

2.15 Find point

This allows the indication of point name and to single them out on the drawing.

2.16 Calculate the convex perimeter

This functions automatically keeps the convex perimeter of a pointed survey. The polygon can be successfully modified to be used as a constraint perimeter for the triangulation.

2.17 Calculate the concave perimeter

This function is available only during triangulation, it generates a polygon that runs the triangulation perimeter profile. It is useful to add and remove triangles from a model or wish to calculate the perimeter or area quickly.

2.18 Triangulation/ Rotrotralation

This allows the processed movements of the survey points in a parametric mode. Notice that the calculation doesn’t influence the triangulation but also the survey points.

2.19 Delete external triangles

This functions result is useful is for example the intersection has to be calculated and the volumes between the two models that have result similar to the biggest part of the surface. So the total calculation works to limit process times, less triangles must be taken into consideration, more velocity will be the final result. Functions on the polygon base introduced by the user, deleting all the triangles that are completely external and itself.

2.20 Level and Divide

It requires a quota from the user and using a horizontal plane, it separates the current model into two new DTM(one superior and one inferior).

2.21 Merge surveys

Numerical models unification. Display the available DTM list in the project and combine all the sections of the current survey.

2.22 Line redimension

Given a selected polyline, it requires the new length, deleting the extending vertices or prolonging the last split.

2.23 Restrict polygon

Similar to offset, it restricts polygon thickness indicated by user

2.24 Dynamic Labels

This allows for line drawing with the mouse and all intersections with an isoline (base curve) placing a quota label.

2.25 Triangular
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Runs a triangulation of the survey points and obtains a homogenous surface of the adjacent triangles and not the overlapped.

Algorithm use:

- *delaunay;*
- *constrained delaunay triangulation;*
- *incremental delaunay triangulation;*
- *Ruppert s mesh refinement anisotropic triangulation.*

2.26 Isolines / Contour line

Obtain crossing lines by an equidistant quote, used to draw the height difference of a surface.

2.27 Isozone

Like as the Isolines, the isozone splits the surface by an equidistant quote. It is possible to obtain singular numerical models for ever isozone o only global model.

2.28 Voronoi

Calculate the vertices and the voronoi sites. Gives a triangulation, this algorithm calculates the triangle centre and in relation to the nearby triangles, keeps the maximum usable area. To understand what it is and why we need it, just imagine the territorial provinces of Holland and know that Holland's territorial administrators have been divided the state based on this type of classification. The provinces centres were taken as vertices for triangulation, and the area results(Voronoi sites) correspond to the maximum extensive geographic.

2.29 Levelling with horizontal plane

Gives a calculated plan quota of a the volume, excavation and report of a numerical

number

2.30 Levelling with an inclined plane (or through three points)

Calculate the volume, the excavation and report based on the definite plane between three known points.

2.31 Intersection between two numerical numbers

Calculate the volume, excavation and report based on the two different numerical models

2.32 Map Image

This function shades the surface with the current coloration to be exported in bitmap and is eventually applied to the 3D display come texture.

2.33 Excavation

This functions to cut the triangled suface. The incision can run surface profile at a prefixed depth, or have a flat base at a pre-set quota. In the road approximation it is possible to indicate the edge width and the road depth

3 How to identify the basin using Trispace

How to identify the basin using Trispace.
TRISPACE also allows reading in a direct way the SRTM files: from the *Apri/Open* menu, select the .srtm file in the openings filter.

Procedure:
Execute the triangulation and trace out the slope vectors from the Elabora/Work out menu.
On the basis of the slope vectors, trace out the polygon which identifies the basin clockwise using the polygon tool.
Trace out the main river pole from uphill to downhill using the polyline tool: this

setting is significant to establish the direction of the water flow in Hydrologic Risk.
From the Elabora/Work out menu, select the Crea bacino idrografico/Create catchment basin control: a file in ASCII format to be imported to Hydrologik will be created.

4 Import of catchment basins from SRTM

The *SRTM* application reachable on **http://www.geostru.com/geoapp/** 9 allows creating the digital model of the ground in an area of interest identifiable through a selection box made up 4 pointes (the vertices of a rectangle).

The ASCII file generated by *SRTM* contains the coordinates x, y and z, separated by ";", relevant to the pints included in the area under examination.
The ASCII file can be worked out using specially dedicated programmes, such as *TRISPACE*, in order to obtain relief maps, contour lines, sections, etc.

TRISPACE allows importing the file worked out by *SRTM*, with Importa file dati/Import data file control from the Dati/Data menu.
The imported file only contains the coordinates of the points: the identification of the basin must consequently be carried out manually.

5 Contact

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