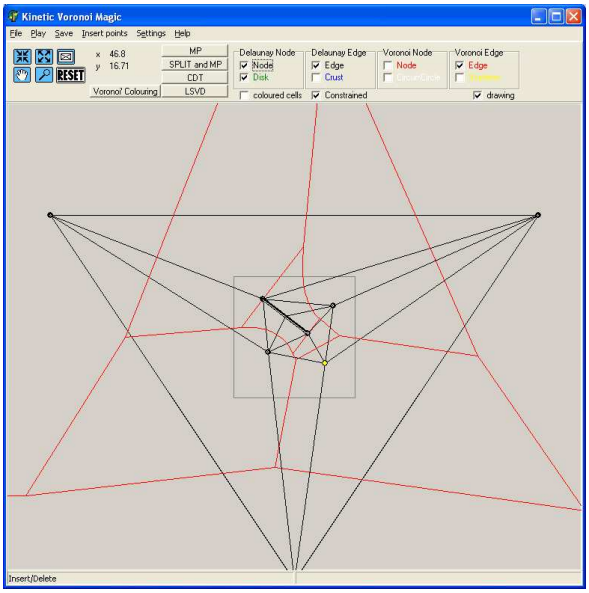
Kinetic Voronoi Magic - TUTORIAL

1 The Program



The program uses an active point. The active point is marked in yellow colour.

1.1 The main menu

- File
    - Open… - open pcl file (pcl=point-contrained-line), containing the bounding box of the mesh in the first line and then coordinates of points (line format: P x y attribute), constrained edges (line format: C x1 y1 x2 y2) and lines (line format: L x1 y1 x2 y2 x1y1attribute x2y2attribute lineLeftAttribute lineRightAttribute). P=point, C – constrained edge, L – line segment. x,y – point coordinates, x1,y1,x2 – two endpoints of the constrained edge or line segment, attribute – point attribute (color, elevation), x1y1attribute x2y2attribute – attributes of line segment endpoints, lineLeftAttribute lineRightAttribute – attributes of left and right half-lines
    - Save… - save the data in pcl file.
    - Add… - add the data to selected pcl file.

    - Read points file (pts)… - create a mesh from points pts file, where each line contains x,y,z coordinates of one point. Points are inserted using Split/Move method.
    - New CDT Mesh from SHP file… - create a CDT mesh from a selected shapefile, lines will be represented by constrained edges (remember to TURN OFF DRAWING first). The file is loaded when the cursor x,y coordinates on the toolbar change with mouse movement.
    - Add CDT from SHP… - add data from a selected SHP file into the existing CDT mesh.
    - New LSVD Mesh from SHP file… - create a LSVD mesh from a selected shapefile, lines will be represented by line segment objects (remember to TURN OFF DRAWING first)
    - Add LSVD from SHP… - add data from a selected SHP file into the existing LSVD mesh.
    - Exit
- Play
    - Save.log – play save.log file
- Save
    - Save.log – record actions in save.log file. The caption of this menu item will change to ‘STOP save.log’. Perform actions (indert, delete, add line segment…) and at the end click ‘STOP save.log’ in the menu to stop recording.
    - Add to save.log – add additional actions to save.log, the caption of this item will change to ‘STOP save.log’. Click ‘STOP save.log’ after finishing. All the action will be added at the end of save.log file.
- Insert points
    - Random… - insert points in a random order
    - Grid… - insert points in a grid pattern.
    - Circle… - insert points on a circle.
- Settings
    - New mesh properties… - set the disk radius for all objects and tolerance value for arithmetic operations.
    - Set constant intervals – set snapping nodes coordinates to integer values, no fraction values.
    - Display properties… - various display properties, like colours, edges width, nodes size.
    - Extract buffer zones – draw buffer zones for nodes
- Help
    - About…

Buttons

- Zoom in – click to zoom in, also mouse wheel
- Zoom out – click to zoom out, also mouse wheel
- Fit to screen – click to fit the mesh to the screen
- Move – when pressed – drag the mesh
- Enlarge – when pressed – click and drag to select the area to be enlaged

- RESET – delete the mesh

Checkboxes – displaying features

- Delaunay node – Delaunay Nodes
- Disk – disks around Delaunay nodes and line segments
- Delaunay edge – Delaunay edges
- Voronoi node – Voronoi nodes
- Voronoi edge – Voronoi edges
- Coloured cells – Voronoi cells filled with colours
- Constrained – constrained edges
- Cursor – to split line segments, clicking inside a Voronoi cell of a line segment splits the segment into two parts.
- Drawing – turning the drawing on or off, turn it off before loading shapefiles (loading large datasets with redrawing on takes log time)

1.2 Program modes

Different modes are entered by pressing the buttons on the toolbar.

1. Insert/delete – when none of the buttons are pressed, left click –insert, right click - delete
2. MP – when 'MP' button is pressed
3. Split and MP – when 'SPLIT and MP' button is pressed
4. CDT – when 'CDT' button is pressed
5. LSVD – when 'LSVD' button is pressed
6. Voronoi Colouring – when 'Voronoi Colouring' button is pressed, user can specify a colour of each cell

1.3 The main operations:

1. Select a point – the current point is marked in yellow colour.
2. Insert a point – insert a new point at the selected location.
3. Move a point (MP) – move the active point to the desired location.
4. Split and move a point (SPLIT and MP) – split a point from the active point and move it to the desired location.
5. Make a constrained edge (CDT) - split a new point from the active point, convert the edge between them to a constrained edge and expand the edge to the desired location.
6. Make a line (LSVD) – split a new point from the active point, create a new line and expand the line to the desired location.
7. Divide a line – divide the line into two lines, when "Cursor" checkbox is ticked.
8. Delete a point – delete a selected point.
9. Delete a line – delete a selected line by shrinking it towards one of its endpoints

1.4 How to…?

1. Set a disk size for the new mesh – before loading a data or drawing a new mesh go to menu Settings -> New mesh properties and set the disk radius value there. Then all inserted points and line segments will have this disk value assigned.

2. Select a point – in Insert/Delete mode – left click inside the disk of selected point – it becomes the active one marked in green colour.
3. Insert a point – in Insert/Delete mode – left click at the desired location, the newly inserted point becomes the active one.
4. Delete a point – in Insert/Delete mode – right click inside the Voronoi cell of the point to be deleted.
5. Move a point - left click at the desired location while "**MP**" button is pressed down – the active point is going to be moved there.
6. Split and move a point - left click at the desired location while "**SPLIT and MP**" button is pressed down – a new point is going to be created from the active point by splitting and moving it to the desired location.
7. Make a constrained edge - left click at the desired location while "**CDT**" button is pressed down – a new constrained edge is going to be created by splitting the active point, converting a new edge between the active point and the split point to a new constrained edge and expanding that edge to the desired location.
8. Make a line - left click at the desired location while "**LSVD**" button is pressed down – a new line is going to be created by splitting the active point, converting a new edge between the active point and the split point to a new line segment and expanding the line segment to the desired location.
9. Divide a line – left click inside an existing line in LSVD mode when the current point is one of the endpoints of that line. Or use the cursor method – tick "cursor" checkbox and then click inside a Voronoi cell of a line segment that you want to split.
10. Delete a line – right click inside the Voronoi cell of the line to be deleted.
11. Connect two existing nodes with a LS or Constrained Edge – in Insert/Delete mode – click on an existing node inside its disk – this node will be selected and marked in yellow, then switch to LSVD or CDT mode and click on the destination node.

1.5 Voronoi Colouring

1. Insert some points and line segments or load a shapefile using 'LSVD Mesh from SHP file' menu option (shapefiles loading with drawing turned off).
2. Turn on 'Coloured cells' checkbox, to display colours of cells.
3. Turn 'Voronoi Colouring' mode – press 'Voronoi Colouring' button
4. Right click opens a dialog window with colours selection – select a current colour and press OK.
5. Left click inside a cell – the current colour will be assigned to that cell. Assign different colours to all the cells.
6. Turn off 'Voronoi Colouring' mode – unclick 'Voronoi Colouring' button.

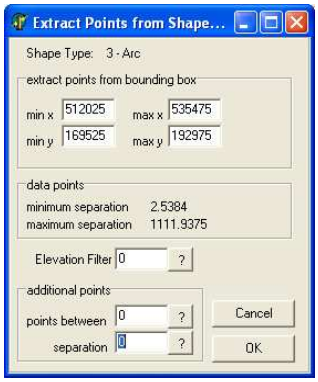
1.6 Reading shapefiles

Shapefile features can be represented by line segment objects or constrained edges.

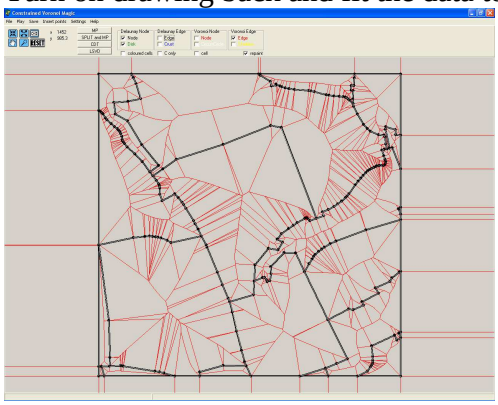
1. **Turn off repainting** (tick off "drawing" checkbox)

2. Load data using Line Segment VD method (menu: File -> LSVD Mesh from SHP file). (examples below after loading pcs_l.shp)
   Available data in 'SHP' folder:
   pcs_l.shp – postcode boundaries
   ub_l.shp – urban area polygons
   cont_l.shp - contourlines
3. Shapefiles are associated with DBF database file storing various attributes of each feature (ID, code, elevation, area). The user has to specify which attribute he wants to use – we usually use elevation attributes, but in this exercise the attributes are not important, so select the first displayed attribute – click YES button answering "ANY_FIELD – is it a height field?" question.

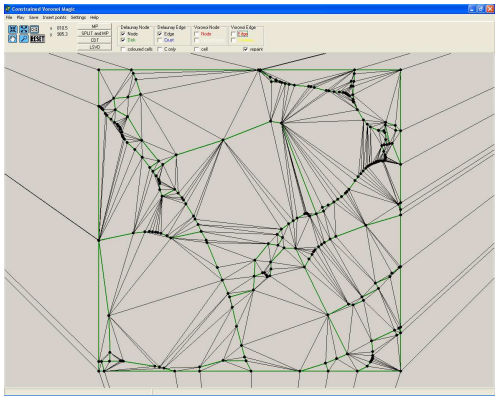
   Then use default properties in "Extract Points from Shapefile" dialog window – click OK button.



   Turn on drawing back and fit the data to the screen (click "the envelope" button)



4. Reset the model (click RESET button).
5. Turn off the repainting and load the same data using Constrained DT method (menu: File -> CDT Mesh from SHP file)
6. Turn on the repainting back and fit the data to the screen (click "the envelope" button)



7. Load another shapefiles.