A survey system for dredging[1]

Brouns G. and A. De Wulf

Ghent University, Department of Geography/Surveying
Krijgslaan 281 - S8
B-9000 Gent
E-mail: gert.brouns@rug.ac.be

In bathymetry, the seafloor's depth is sounded at discrete spots. For dredging works, it is important to have as good a terrain model as possible, as well before dredging starts as after the work has been carried out.

The latest bathymetric sounding equipment that is available nowadays, especially the multibeam echosounder, yield a very dense bottom sampling. When compared to the common singlebeam echosounder, an enormous amount of data is produced that needs to be processed in a correct and fast way. Grid-overlay (linear interpolation by means of a regular mesh) is not an option here as this method yields an interpolation of the measured values and hence will either cause accuracy loss or generate a still larger amount of data. A triangular irregular network (TIN for short), especially the Delaunay triangulation (Dt), does respect the actual measurements and will not generate new data. In literature, a number of algorithms have been developed that determine the Dt of a set of points given in the plane.

The speed of an algorithm is expressed as a function of n, the number of points to be processed. A straightforward algorithm to obtain a Dt is adding the points one by one to an initial triangulation made of a subset of the data. This method requires n^2 manipulations. However, algorithms exist, under which a *divide-and-conquer* algorithm, that require only $n.log(n)$ manipulations. That has been proved to be theoretically the best possible performance. This means a considerable gain in calculation time of the concerned data files, which typically will contain about 10^6 points. It will be clear that the processing time for both algorithms will even more diverge for increasing data sets.

Therefore, the first and most important part of the project consists of optimally implementing the divide-and-conquer algorithm. This is done in Object Pascal under Delphi. Delphi also allows to easily create a user interface.

A next step is to introduce breaklines. Breaklines will mainly occur in the design models. The height along these lines is theoretically fixed and should not be cut by any triangle edges of the Dt.

Part of the immense amount of data generated by a multibeam echosounder will unavoidably be redundant. An important issue therefore will be: filtering these data, keeping those points that still assure an optimal accuracy for the final volume calculations.

Another required function is manual editing of the TIN. Adding points can be done by reusing the already implemented incremental algorithm. Deleting points remains to be sorted out.

In a later phase, once the core of the program is finished, other user friendly features will be added.

---

[1] 'Survey-systeem voor het baggeren' is an IWT project in collaboration with the University of Ghent, Geography Department and Dredging International NV