# BREAKLINE DETECTION EMBEDDED IN A HYBRID MESHING SCHEME

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In environmental and hydrodynamic engineering analysis, forecasts and assessments traditionally rely on measurements and experiments. In addition to this traditional approach, numerical simulations gained importance in the last decades. These numerical simulations are often based on the methods of finite elements, finite differences or finite volumes. For the application of these methods discrete element meshes of the considered topography are required. With respect to the applied method, these element meshes have to fulfil specific requirements regarding edge ratio, element angles and element size. In practice, these requirements vary between different areas of the domain. Therefore, a hybrid meshing scheme is presented by Rath et al. (2005) with the following key ideas: regular element meshes for river beds and slopes in order to specify edge ratio and element orientation; irregular triangle meshes for forelands. Element meshes have to approximate the topography with sufficient accuracy. All characteristic terrain features with an influence on the hydrodynamic behaviour have to be represented in the element meshes. Rath and Pasche (2004) and Rath et al. (2005) presented slope classification and breakline identification methods in detail. In this contribution the enhancements of these terrain feature analysis and the embedding in the hybrid meshing scheme are explained. The terrain analysis and meshing functionality is implemented in the software tool HybridMesh.

Numerical simulations of water levels, flow velocities or sediment transport require element meshes which approximate the considered topography sufficiently accurate and which represent all significant terrain features. The case study shown in figure 6 represents a digital terrain model of a tributary to the River Danube. Different characteristics of this topography are obvious: The resolution of measurement points in the area of the river bed and the river slope is 4 m. In contrast to this, the resolution in the foreland area is 20 m. In addition to these two different resolution areas, a fine resolution of 1 m is used to describe significant terrain features in the area of the river bed and of forelands. These different resolution areas of the topography point out the necessity for separate considerations of different meshing areas and for a hybrid meshing scheme.

The software tool HybridMesh combines the functionality of breakline identification

(Rath and Pasche, 2004) and triangular irregular networks based on Delaunay refinement (Rath and Bajat, 2004) with the functionality of regular mesh generation based on free form surfaces (Berkhahn et al., 2002)(Berkhahn and Mai, 2004). This HybridMesh tool is developed by the authors of this paper and is an enhancement of the HydroMesh tool (Göbel, 2005). HybridMesh is implemented with the Java programming language and will be available as open source software.

*Keywords:* Terrain feature analysis, breakline identification, hybrid element meshing scheme, regular meshes on b-spline surfaces, irregular triangle meshes.

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