

Pre- and post-processing unstructured grids with the PUG Matlab toolbox

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The advantages of using unstructured grid models for marine and riverine hydrodynamic applications are numerous and not to be demonstrated anymore. High flexibility to define variable mesh densities and smooth representation of complex coastlines are among the most significant benefits of such models and may justify their use despite substantial drawbacks, such as relatively high computer cost.

Many software tools can be found freely on the internet to generate unstructured grids, all with pros and cons. However, none of them offer satisfactory built-in functionalities to define easily the contour of a real domain, while this can be a painful task to achieve. Indeed, most of the time, available data come from several sources of different types, and their combination is handmade, so that everything must be done from scratch for each new grid. Another issue is the lack of a standard file format to save unstructured grids or model outputs. As a result, many different file formats coexist, and the choice of a specific grid generation tool is often driven by its possible output file formats rather than its mesh generation capabilities.

The PUG1 Matlab toolbox is developed with the aim to offer solutions to those challenges encountered by many unstructured grid modelers. Firstly, it gathers several functionalities to define domain contours in an integrated framework. Secondly, it can convert several unstructured grid file formats between them. So far, as the development of the toolbox is driven by the needs at Flanders Hydraulics Research, the toolbox functionalities are limited to the grid generation with Gmsh and the conversion of Gmsh grids into TELEMAC input files. However, they can be easily extended to other file formats by external users. The presentation of the PUG Matlab toolbox will be here illustrated by the generation of unstructured grids for a storm surge model of the Belgian continental shelf.