A three-dimensional unstructured mesh generation method for environmental reservoir simulation analysis

Hyun Ho Shin **Pedro Henrique Lins Costa*** **Norberto Mangiavacchi**
Depto de Engenharia mecânica, UERJ
20550-013, Rio de Janeiro, RJ, Brazil
E-mail: hshin@gmail.com, pedro.lins.costa@gmail.com, norberto.mangiavacchi@gmail.com,
Christian E. Schaerer
Facultad de Politécnica, UNA
Campus Universitario, SL, Paraguay
E-mail: cschaer@pol.una.py,
Cássio Botelho Pereira Soares
Departamento de Engenharia Ambiental, Furnas Centrais Elétricas, S.A.
22281-900, Rio de Janeiro, RJ, Brazil.
E-mail: cassiobp@furnas.com.br.

ABSTRACT

This work presents a three-dimensional unstructured mesh generator for the analysis of hydroelectric power plants reservoirs using finite element methods. In order to obtain an accurate simulation of the physical flow of interest, the discrete mesh needs to consider adequately the geophysical data employed for the definition of the domain. The proposed algorithm is practical, stable and able to deal with different types of geophysical input data producing well conditioned three-dimensional meshes.

We implemented the proposed algorithm in C++ in the context of a project for the analysis and evaluation of environmental impacts of hydroelectrical reservoirs. The algorithm is able to deal with several kinds of geophysical data, as well as, data with a huge relationship between the average of horizontal width and depth, which is a common situation in reservoir engineering.

An advantage of the algorithm is the point insertion routine. This allows to easily implement a refinement of the mesh in order to increase the approximation of the simulation.

References

[1] M. Berg, "Computational Geometry: Algorithm and Applications", Springer-Verlag Berlin Heidelberg New York, Second Revised Edition, 2000.

[2] J. Donea and A. Huerta, "Finite Element Methods for Flow Problems", J. Wiley, West Sussex, 2003.

[3] D. J. Mavriplis, "Unstructured Grid Techniques, *Annual Review Fluid Mechanics*, 29 (1997) 473-514

[4] D. M. Mount, "Computational Geometry, Lecture Notes, Department of Computer Science, University of Maryland, 2002.

[5] J. O'Rourke, "Commputational Geometry in C", Cambridge University Press, Massachusetts, Second Edition, 1997.

[6] D. Shojaee, H. Helali and AA. Alesheikh, Triangulation for Surface Modelling, in "Ninth International Symposium on the 3D Analysis of Human Movement", France, 2006.

*Research Student PIBIC/UERJ