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ON CLASSIFICATION OF THE MESHLESS METHODS

J. Orkisz[2] , J. Krok[1],

[1] Cracow University of Technology
Warszawska 24, 31-155 Krakow, Poland
plkrok@cyf-kr.edu.pl

[2] Cracow University of Technology
Warszawska 24, 31-155 Krakow, Poland
plorkisz@cyf-kr.edu.pl

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ABSTRACT

In the recent years a rapid development of the meshless methods (MM) is observed. Under this name we understand a variety of methods (used to analyse b.v. problems) characterized by the following common feature: they use a local approximation of function based on unstructured cloud of nodes instead of any rigid structure like elements or regular mesh. They constitute nowadays a more and more powerful tool of computational analysis of various scientific and engineering problems, successfully competing with the classical FEM. Their development may be measured by the rapidly growing number of publications including several monographs like [1,2], and by the number of scientific conferences (e.g. [3]) and seminars.

Nowadays one may count altogether about hundred different names of the MM. On the other hand such rapid development introduces certain disorder. Many papers and presentations are based on very similar or even identical concepts. They often differ only by the names of the authors or by the methods' name.

Therefore, in the current stage of development of the MM, a classification of these methods is more and more needed, possibly using a standardized nomenclature.

Several preliminary attempts of such classification have been already undertaken [4,5,6,7,8,]. The authors used different concepts as a base of such classification, like the type of mathematical formulation of the b.v. problems or the type of the local approximation applied.

However, the result of these attempts is still not satisfactory, e.g. a variety of the MM remained beyond the classifications proposed. This may be mainly caused by both rapid development of the MM, and a very wide variety of different methods included in this broad class.

The principal objective of this paper is to present a review of the main contemporary MM concepts, as well as to use this knowledge in order to propose and discuss a classification of these methods. The recent development trends of the MM will be also discussed. Moreover several chosen problems of the MWLS approximation like selected of optimal parameters, evaluation of function derivatives, error analysis, and MM/FEM coupling will be considered. Several examples of the MM applications will be given.

REFERENCES

[1] Atluri Satya N., *The meshless method (MLPG) for domain & BIE discretizations*, Tech Science Press, Forsyth, GA, USA, 2004.

[2] Liu G.-R., *Meshfree methods*, CRC Press LLC, London, 2003.

[3] Griebel M., Schweitzer M.A. (Eds), *Meshfree methods for partial differential equations*, Springer-Verlag, Berlin, 2003, 2005, 2007.

[4] Belytschko T., Krongauz Y., Organ D., Fleming M., Krysl P., Meshless methods: An overview and recent developments, *Computer Methods in Applied Mech. and Eng.*, 139, 3-47, 1996.

[5] Duarte C.A., A review of some meshless methods to solve partial differential equations. Technical Reports, 1995-06, TICAM, University of Texas at Austin, 1995.

[6] Orkisz J., Finite Difference Method (Part III), in *Handbook of Computational Solid Mechanics*, M.Kleiber (Ed.), Springer-Verlag, Berlin, 336-432, 1998.

[7] Li S., Liu W.K., Meshfree and particle methods and their applications, *Applied Mechanics*, 55, 1-34, 2002.

[8] Fries T.P., Classification and overview of meshfree methods, Technical University Braunschweig, Brunswick, Germany, Informatikbericht 2003-3, July 2004.