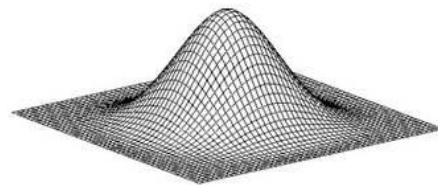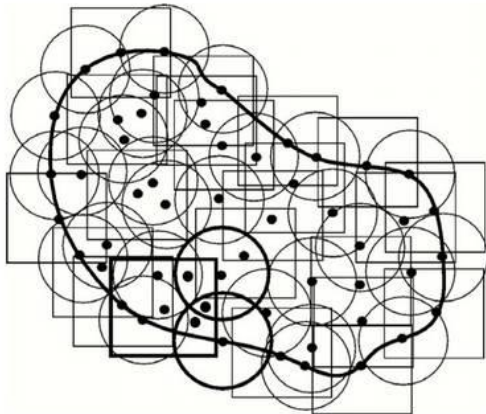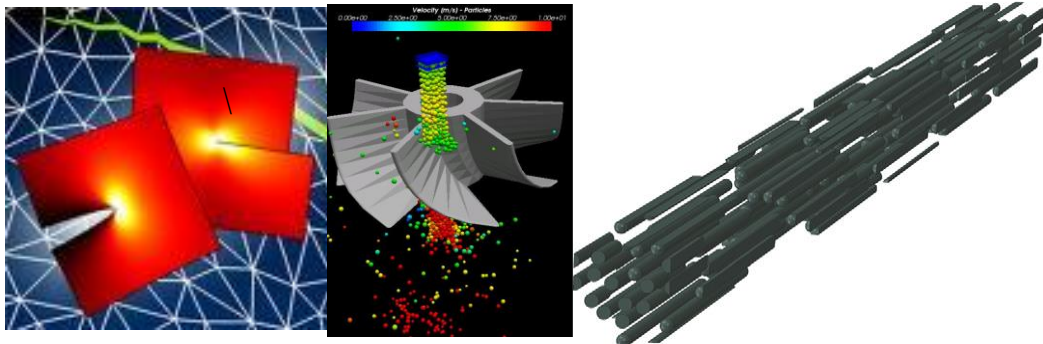# New methods in computational mechanics (MECA0470-1)

Group project: Presentation of an emerging method

Meshfree Shape Function

Maarten Arnst, Eric Béchet, Ludovic Noels

Academic year 2019-2020

LIÈGE université

__Assignment__

Each group of 2 to 3 students will prepare a presentation on an emerging method in computational mechanics. In particular, it is required to respect the instructions A to D.

__A/ Presentation:__

This consists in an oral talk with the slides as written support:

- The language will be English ;
- The presentation will hold 30 minutes followed by 15 minutes of questions ;
- Both ppt et pdf versions of the slides will be sent electronically ;
- A printed version of the slides will be the written report.

__B/ Content:__

The talk will cover the following content
- Introduction of the method
    - Goal
    - Key ideas
    - Brief state of the art study
- Main equations and demonstrations related to the method
    - The ones required for a good understanding will be presented
    - The other ones can be in appendix
- The method will be illustrated by an implementation
    - The method has to be implemented on a simple exemplified problem
    - The source code has to be sent electronically
- Limits/drawbacks of the method
    - Inherent to the method
    - Not solved yet
- Perspectives
    - Which applications?

__C/ Resources:__

The project will be conducted based on a literature study
- Some key references are provided
- A bibliographic study can be done using http://scholar.google.be/, www.scopus.com
    - Directly accessible from ULg
    - Require VPN outside ULg

__D/ Deadline:__

- Report and code (sent electronically): 7th of May 2019
- Presentation: 14th of May 2019 at 2pm (to be confirmed)

Group 1: The virtual element method for elliptic problems

- Blanca Ayuso de Dios, Konstantin Lipnikov and Gianmarco Manzini (2016) "The nonconforming virtual element method", ESAIM: M2AN, 50 3 (2016) 879-904, https://doi.org/10.1051/m2an/2015090, https://www.esaim-m2an.org/articles/m2an/pdf/2016/03/m2an150085.pdf

- L. Beirão da Veiga, F. Brezzi, L. D. Marini and A. Russo (2014) "Virtual Element Method for general second-order elliptic problems on polygonal meshes", Mathematical Models and Methods in Applied Sciences, Vol. 26, No. 04, pp. 729-750, https://doi.org/10.1142/S0218202516500160, https://arxiv.org/pdf/1412.2646.pdf

- Arun L. Gain, Cameron Talischi, and Glaucio H. Paulino (2014), "On the Virtual Element Method for three-dimensional linear elasticity problems on arbitrary polyhedral meshes", Computer Methods in Applied Mechanics and Engineering, Volume 282, 132-160, https://doi.org/10.1016/j.cma.2014.05.005, http://www.sciencedirect.com/science/article/pii/S0045782514001509

- Andrea Cangiani, Gianmarco Manzini, and Oliver J. Sutton (2017), "Conforming and nonconforming virtual element methods for elliptic problems", IMA Journal of Numerical Analysis, Volume 37, Issue 3, Pages 1317–1354, https://doi.org/10.1093/imanum/drw036, https://academic.oup.com/imajna/article-pdf/37/3/1317/18524063/drw036.pdf

- E.Artioli, L. Beirão da Veiga, C. Lovadina, and E. Sacco. (2017), "Arbitrary order 2D virtual elements for polygonal meshes: part I, elastic problem". Comput Mech 60, 355–377, https://doi.org/10.1007/s00466-017-1404-5, https://link.springer.com/content/pdf/10.1007/s00466-017-1404-5.pdf