



Director  
Patrizia Trovalusci

# Sapienza Università di Roma

## PhD Program in Structural and Geotechnical Engineering

June 23 and 24, 2025

09:00am-11:00am

June 26 and 27, 2025

2:00pm-6:00 pm

**Prof. Elio Sacco**

*Full Professor, Department of Structures for Engineering and Architecture, University of Naples "Federico II"*

**Dr. Marco Pingaro**

*Assistant Professor, Department of Structural and Geotechnical Engineering, Sapienza University of Rome*

## Virtual element Method (VEM) for Fracture Mechanics/Elements of Programming with Python and Applications with VEM

In the last 10 years, a new finite element methodology, the virtual element method (VEM), has been proposed by Brezzi, Beirão da Veiga and coworkers. The VEM is more flexible than standard FEM, as it is possible to discretize the domain by polygons characterized by any number of edges, without constraints. Moreover, it has also been proved that VEM presents several advantages with respect to classical FEM, such as ability to accurately deal with complex geometries, flexibility in mesh generation, no need of a parent element, easy polynomial degree elevation, very good performances for distorted meshes. The lectures are devoted to the development of a virtual element method with application in fracture mechanics. The basic concepts of the VEM and the construction of all operators involved in the construction of the mathematical formulation will be explained during the course. Some detail concerning the VEM implementation in a Python framework will be given in order to enable the course participants to implement a virtual element. Then, a procedure for reproducing the nucleation and propagation of fracture in 2D cohesive media, combining the virtual element technique with a splitting methodology and a minimal remeshing procedure will be discussed and possible applications will be illustrated.

Program: [https://phd.uniroma1.it/web/corso---virtual-element-method-vem-for-fracture-mechanicselements-of-programming-with-python-and-applications-with-vem\\_nS22806IT\\_IT.aspx](https://phd.uniroma1.it/web/corso---virtual-element-method-vem-for-fracture-mechanicselements-of-programming-with-python-and-applications-with-vem_nS22806IT_IT.aspx)

Registration form:

[https://docs.google.com/forms/d/e/1FAIpQLSdMeBiX42KtPBqjRgQmNNYKwEh1rIVOWs1buHrCCnom\\_zdVUw/viewform?usp=dialog](https://docs.google.com/forms/d/e/1FAIpQLSdMeBiX42KtPBqjRgQmNNYKwEh1rIVOWs1buHrCCnom_zdVUw/viewform?usp=dialog)



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