

# INSALATE DI MATEMATICA

presents

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*The Lightning Virtual Element Method*



## Abstract:

The Virtual Element Method (VEM) is a method for discretizing partial differential equations (PDEs) developed in 2013. This talk introduces the Lightning Virtual Element Method (LVEM). This new VEM eliminates the stabilization term by actually computing the basis functions using rational functions. Thanks to the lightning Laplace solver by N. Trefethen, the LVEM approximates the basis functions using rational functions with poles clustered exponentially close to the corners of each element of the polygonal tessellation. This results in two great advantages. First, the mathematical analysis of a priori error estimates is much easier and essentially identical to the one for any other non-conforming Galerkin discretization. Second, the fact that the lightning VEM computes the basis functions allows the user to access the point-wise value of the numerical solution without needing any reconstruction techniques. The cost of the local construction of the VEM basis is the implementation price that one has to pay for the advantages of the lightning VEM method, but the parallelizable nature of this operation will ultimately result in a cost-efficient scheme compared to standard VEM and FEM.

## Keywords:

Virtual Element Method · Rational Functions · Stabilization free

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*"Obvious" is the most dangerous word in mathematics.  
(Eric Temple Bell)*