Educational Series & Academy

HIGH-ORDER ACCURATE NUMERICAL METHODS IN AERONAUTICS AT THE EXASCALE

The aim of this course is to present an overview of high-order accurate numerical methods for mathematical problems that arise in aeronautical and aerospace engineering. Numerical schemes are referred to as high-order accurate when a suitably defined error measure e is a function of the mesh size h as e~h^p, with p⩾3. High-order accuracy is of significant engineering interest in numerical methods because it allows the solution of computational problems with a smaller number of degrees of freedom and higher convergence rates of the error with respect to low-order numerical schemes.
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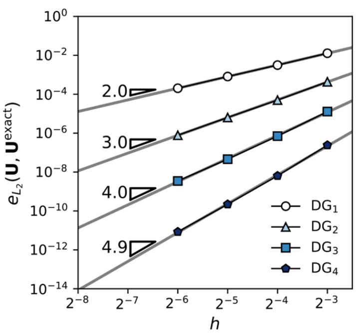
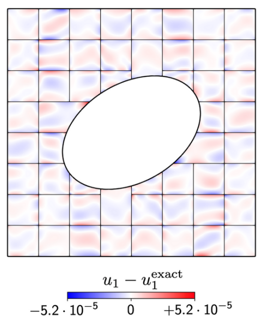
The course is organized as follows:

1. Introduction to two classes of partial differential equations (PDEs), namely hyperbolic PDEs and elliptic PDEs; parabolic PDEs will also be mentioned. Overview of different high-order accurate numerical schemes. Formulation of DG methods for these classes of PDEs. Computer implementation and parallelization aspects.
2. Application to solid and structural mechanics
3. Application to fluid mechanics
4. Hands-on on a simple solid-mechanics problem and a simple fluid-mechanics problem. Each attendee will choose either of these.

The presentation of the course is supported by a set of slides in PDF format that will be made available to the attendees. A Python code will also be provided for the hands-on problems.





LEARNING OBJECTIVES

At the end of the course, the attendees will be introduced to different sets of PDEs that are employed to model various solid, structural and fluid mechanics problems in aeronautical and aerospace engineering. The attendees will be familiar with the features of DG methods and will know the basis to develop a high-order numerical scheme for these sets of PDEs. The course will also provide insight on current and future trends for DG methods, which are an active research area. The course provides a brief mathematical introduction to the topic, but it will be mostly driven by the engineering applications rather than the theoretical aspects.

Target audience: Doctoral students, non-academic professionals, and undergraduate students.

Dates and time: 21-22 September 2022, 9:00-13:00 CEST

REGISTRATION AND CONTACTS

Course Code: 20220921

This course is part of the 2022 institutional activity for AIDAA members. The registration requires the purchase of one of the packages described here https://www.aidaa.it/package-list/, and the completion of the online form available on AIDAA webpage.

Course platform: Webex, a link will be sent via email as the registration is complete**.**
At the end of each course, **attendance certificates** will be sent to participants via email.

For further info, please, contact **academy@aidaa.it**

SPEAKER

Vincenzo Gulizzi is Assistant Professor (RTDb) of Aerospace Engineering at the Department of Engineering of the Università degli Studi di Palermo (Unipa). Before joining Unipa, he was a postdoctoral researcher at the Center for Computational Sciences and Engineering of the Lawrence Berkeley National Laboratory in Berkeley, California, USA. Vincenzo's research interests are in the fields of computational modelling and applied mathematics for aerospace engineering. Recently, he has been working on high-order accurate methods in computational science: he has developed several formulations based on the discontinuous Galerkin method for the analysis of composite multilayered plates and shells, wave propagation in multi-phase solids and compressible fluid flow. He has also worked in the areas of anisotropic fracture mechanics, buckling and post-buckling analysis of composite structures and boundary element methods for meso-scale fracture-mechanics of polycrystalline materials. Prior to his experience in computational sciences, he worked on experimental techniques for non-destructive evaluation methods and structural health monitoring based on guided waves and the electromechanical impedance method.