



**UNIVERSITÀ
DI TRENTO**
Dipartimento di
Matematica

DOTTORATO



CYCLE 35th
ORAL DEFENCE OF THE PHD THESIS

Friday 21 April 2023 – at 11.00 am
Department of Mathematics
Seminar Room 1

The event will take place in presence and online through the ZOOM platform.
To get the access codes please contact the secretary office

Fabio Cassini

PhD Student in Mathematics

Exponential integrators: tensor structured problems and applications

Abstract:

The solution of stiff systems of Ordinary Differential Equations (ODEs), that typically arise after spatial discretization of many important evolutionary Partial Differential Equations (PDEs), constitutes a topic of wide interest in numerical analysis. A prominent way to numerically integrate such systems involves using exponential integrators. In general, these kinds of schemes do not require the solution of (non)linear systems but rather the action of the matrix exponential and of some specific exponential-like functions (known in the literature as φ -functions). In this PhD thesis we aim at presenting efficient tensor-based tools to approximate such actions, both from a theoretical and from a practical point of view, when the problem has an underlying Kronecker sum structure. Moreover, we investigate the application of exponential integrators to compute numerical solutions of important equations in various fields, such as plasma physics, mean-field optimal control and computational chemistry. In any case, we provide several numerical examples and we perform extensive simulations, eventually exploiting modern hardware architectures such as multi-core Central Processing Units (CPUs) and Graphic Processing Units (GPUs). The results globally show the effectiveness and the superiority of the different approaches proposed.

Supervisor: Marco Caliari

CONTATTI

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