

# Exponential Time Integrators: Theory and Practice

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## SUMMARY

Large stiff systems of differential equations are routinely employed in a variety of fields, including fluid mechanics, plasma physics, chemical and geo-engineering, and climate modeling. Such models can describe a multitude of physical processes simultaneously evolving over a wide range of temporal scales, with very long time scales of interest compared to the fastest modes in the system. Over the past decades, exponential integrators emerged as an efficient alternative to standard implicit time integrators for large stiff systems of differential equations. In this talk we will provide an overview of the field of exponential integrators and discuss the latest advances in the construction of such methods. We will describe different classes of exponential methods designed to address particular types of problems. Methodologies for constructing particularly efficient methods that are either classically and stiff accurate will be discussed. In addition, we will talk about publicly available software packages for serial and parallel platforms. Finally, we will outline promising directions and open questions in the field of exponential time integration.

**Keywords:** exponential integration, time integrators, numerical methods

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