

Thematic Semester on
QUANTUM MATHEMATICS

The Mathematics inspired by Quantum Mechanics

Recent results on Magnus-type integrators and applications to quantum systems

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Abstract: In this talk, I will review recent results on commutator-free quasi-Magnus exponential integrators for non-autonomous evolution equations with applications in quantum physics.

Commutator-free quasi-Magnus exponential integrators are (formally) given by a composition of several exponentials that comprise certain linear combinations of the values of the defining operator at specified nodes. Avoiding the costly evaluation of commutators, they provide a favourable alternative to standard Magnus integrators, in particular for large-scale applications.

Non-autonomous linear evolution equations also arise as a part of more complex problems, for instance in connection with nonlinear evolution equations of the form $u'(t) = A(t)u(t) + B(u(t))$. A natural approach is thus to apply operator splitting methods combined with commutator-free quasi-Magnus exponential integrators. Relevant applications include Schrödinger equations with space-time-dependent potential describing Bose-Einstein condensation.

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