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Low-regularity exponential-type integrators for the KdV equation

Meanwhile, a large toolbox of numerical schemes for evolution equations was established, based on different discretization techniques such as discretizing the variation-of-constants formula (e.g., exponential integrators) or splitting the full equation into a series of simpler subproblems (e.g., splitting methods). In many situations these classical schemes allow a precise and efficient approximation. This, however, drastically changes whenever "non-smooth" phenomena enter the scene such as for problems at low-regularity and high oscillations. Classical schemes fail to capture the oscillatory parts within the solution which leads to severe instabilities and loss of convergence. In this talk I present a new class of low-regularity exponential-type integrators for the Korteweg-de Vries (KdV) equation. The key idea in the construction of the new schemes is to tackle and hardwire the underlying structure of resonances into the numerical discretization. This allows for a robust and stable approximation overcoming any CFL-type condition.