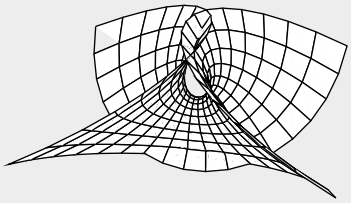

Oberseminar Mathematische Strömungsmechanik

Institut für Mathematik der Julius-Maximilians-Universität Würzburg

Hyperbolic equations - structure preserving methods & other topics

Mohammed Lemou

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Highly-oscillatory evolution equations: averaging and numerics

Abstract:

Usual numerical methods become inefficient when they are applied to highly oscillatory evolution problems (order reduction or complete loss of accuracy). The numerical parameters must indeed be adapted to the high frequencies that come into play to correctly capture the desired information, and this induces a prohibitive computational cost. Furthermore, the numerical resolution of averaged models, even at high orders, is not sufficient to capture low frequencies and transition regimes.

We present two strategies allowing to remove this obstacle for a large class of evolution problems : a 2-scale method and a micro/macro method. We consider both the constant frequency and variable - possibly vanishing - frequency frameworks. We show that the hierarchy of averaged models in the vanishing case is more complex than in the constant frequency case and in particular stationary-phase effects come into play. The result of these approaches is the construction of numerical schemes of arbitrary order whose accuracy no longer depends on the frequency of oscillation, one then speaks of uniform accuracy (UA) for these schemes.

Finally, a new technique for systematizing these two methods will be presented. Its purpose is to reduce the number of inputs that the user must provide to apply the method in practice. In other words, only the values of the field defining the evolution equation (and not its derivatives) are used. These methods have been successfully applied to solve a number of evolution models: non-linear Schrödinger and Klein-Gordon equations, Vlasov-Poisson kinetic equation with strong magnetic field, quantum transport in graphene.

via Zoom video conference (request the Zoom link from klingen@mathematik.uni-wuerzburg.de)

Friday, Apr. 23, 2021 at 3 pm CET

Zu diesem Vortrag sind Sie herzlich eingeladen.

gez. Christian Klingenberg