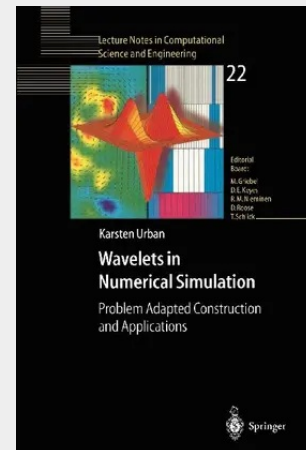


Wavelets in Numerical Simulation

Problem Adapted Construction and Applications

Sapere aude! Immanuel Kant (1724-1804) Numerical simulations play a key role in many areas of modern science and technology. They are necessary in particular when experiments for the underlying problem are too dangerous, too expensive or not even possible. The latter situation appears for example when relevant length scales are below the observation level. Moreover, numerical simulations are needed to control complex processes and systems. In all these cases the relevant problems may become highly complex. Hence the following issues are of vital importance for a numerical simulation: - Efficiency of the numerical solvers: Efficient and fast numerical schemes are the basis for a simulation of 'real world' problems. This becomes even more important for realtime problems where the runtime of the numerical simulation has to be of the order of the time span required by the simulated process. Without efficient solution methods the simulation of many problems is not feasible. 'Efficient' means here that the overall cost of the numerical scheme remains proportional to the degrees of freedom, i. e., the numerical approximation is determined in linear time when the problem size grows e. g. to upgrade accuracy. Of course, as soon as the solution of large systems of equations is involved this requirement is very demanding.

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