Abstract:
Since modern numerical simulation is a transdisciplinary field of research, the question often arises up to which extent this fact should be reflected by the content of single courses as well as by the structure of the whole respective study programs. Here, an issue that is disputed especially hotly is how and where to keep the balance between an application-oriented education on the one hand, trying to start from real-life problems, and a more concept-based one on the other hand, where the focus is on deriving and depicting general principles of algorithm development that may be fruitful for completely different problem classes. In this paper, we give two examples of such a general algorithmic framework -- octrees as an efficient interface of geometric modelling and numerical simulation, and sparse grids as an a priori optimised grid setting for tasks such as numerical quadrature or the numerical solution of PDE. Both are based upon a hierarchical approach, which turns out to be an advantageous strategy for a large variety of problems.

Stichworte:
efficient numerical algorithms, octrees, sparse grids, teaching computational science and engineering