In this paper we address various efficiency aspects of finite element (FE) simulations on vector computers. Especially for the numerical simulation of large scale Computational Fluid Dynamics (CFD) and Fluid-Structure Interaction (FSI) problems efficiency and robustness of the algorithms are two key requirements. In the first part of this paper a straightforward concept is described to increase the performance of the integration of finite elements in arbitrary, unstructured meshes by allowing for vectorization. In addition the effect of different programming languages and different array management techniques on the performance will be investigated. Besides the element calculation, the solution of the linear system of equations takes a considerable part of computation time. Using the jagged diagonal format (JAD) for the sparse matrix, the average vector length can be increased. Block oriented computation schemes lead to considerably less indirect
addressing and at the same time packaging more instructions. Thus, the overall performance of
the iterative solver can be improved. The last part discusses the input and output facility of
parallel scientific software. Next to efficiency the crucial requirements for the IO subsystem in a
parallel setting are scalability, flexibility and long term reliability.