1 Influence of different factors in line implicit solution methods

1.1 Motivation

The development of accurate, reliable and efficient numerical algorithms to approximate a solution of the Navier-Stokes equations is an enduring challenge in the field of computational fluid dynamics (CFD). For example, the simulation of an unsteady full high-lift configuration of an airplane requires a robust and efficient solver.
To improve significantly the reliability and efficiency of the TAU flow solver developed at the Deutsches Zentrum für Luft- und Raumfahrt e.V. so-called line implicit solution methods have been integrated into the code. This method is designed to deal with stiffness which is introduced into the equations by large anisotropies arising from boundary layer resolution.

1.2 Exercise

For several representative testcases the line implicit method has shown promising results and its superiority when compared with traditional explicit Runge-Kutta methods, which are usually applied in CFD solvers designed for unstructured meshes. However, the line implicit solution method is strongly influenced by several important factors. To get a better understanding and a broader background numerical studies with respect to these parameters are required.

It is the goal of this work to investigate the influence of several different parameters within the framework of the line implicit solution method for a representative bunch of academic and industrial testcases. Moreover, it is also required to analyze the interplay of these different parameters.