Automatic Differentiation Techniques for Aerodynamic Shape Optimization

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We focus on how to efficiently conpute gradient vectors for aerodynamic shape optimization problems by the use of the reverse mode of automatic differentiation (AD). The state equations are the Euler as well as Navier-Stokes equations, either laminar or turbulent. Both methods of AD, operator overloading and source transformation, are applied to aerodynamic shape optimization problems. Here, the computed gradient vectors are relatively large in size and the memory problems of AD are solved by applying two innovative techniques for steady state problems. The first technique is the reverse propagation technique and the other one is the one-shot optimization approach. Furthermore, we present techniques for the MPI parallelization of AD-generated adjoint routines in this context.

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