

Adjoint-Based Optimization with Non-Linear Constraints Applied to Turbulent Mixing

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Thanks to the continuing increase of computational resources, it is at present possible to apply adjoint-based optimization of large parameter sets to the optimization of turbulent flow phenomena. This study focusses on the handling of linear and non-linear constraints in case of optimization of turbulent mixing. We consider the optimization of initial perturbations of the velocity field, such that the turbulent mixing at the end of the flow simulation is maximum. Two constraints apply to these initial perturbations: a continuity constraint, being linear, and an energy constraint, which is nonlinear. The first is enforced using parameter elimination. For the nonlinear constraint a gradient-projection method is compared to the augmented Lagrangian method. We find that the gradient-projection method is more robust than the augmented Lagrangian. Further, the latter method is not always yielding satisfactory optima and the method appears very sensitive to the computational resolution. Moreover the gradient projection method converges towards a reference solution.