Energy dissipation in turbulence

Mustafa Aggul *

Abstract A method is presented, that combines the defect and deferred correction approaches to approximate solutions of Navier-Stokes equations at high Reynolds number. The method is of high accuracy in both space and time, and it allows for the usage of legacy codes (a frequent requirement in the simulation of turbulent flows in complex geometries). The two-step method is considered here; in order to obtain a regularization that is second order accurate in space and time, the method computes a low-order accurate, stable and computationally inexpensive approximation (Backward Euler with artificial viscosity) twice. The results are readily extendable to the higher order accuracy cases by adding more correction steps. Both the theoretical results and the numerical tests provided demonstrate that the computed solution is stable and the accuracy in both space and time is improved after the correction step. We also perform a qualitative test to demonstrate that the method is capable of capturing qualitative features of a turbulent flow, even on a very coarse mesh.

* Michigan Technological University. Email: maggul@mtu.edu.