The Importance of Non-Linearity on Turbulent Fluxes

Two new non-linear models for the turbulent heat fluxes are derived and developed from the transport equation of the scalar passive flux. These models are called as non-linear eddy diffusivity and non-linear scalar flux. The structure of these models is compared with the exact solution which is derived from the Cayley-Hamilton theorem and contains a three term-basis plus a non-linear term due to scalar fluxes. In order to study the performance of the model itself, all other turbulent quantities are taken from a DNS channel flow data-base and thus the error source has been minimized. The results are compared with the DNS channel flow and good agreement is achieved. It has been shown that the non-linearity parts of the models are important to capture the true path of the streamwise scalar fluxes. It has also been shown that one of model constant should have negative sign rather than positive, which had been used in other studies.

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