6th European Conference on Computational Mechanics (ECCM 6)
7th European Conference on Computational Fluid Dynamics (ECFD 7)
11 – 15 June 2018, Glasgow, UK

A Scale-Determining Model with a Focus on Low-Reynolds Number and Near-Wall Turbulence

Jo-Soon Cheong[1], Youhwan Shin[2,*] and Min-Ho Kang[3]

[1] Gunjang Energy Co., Ltd., Inhaero 333, Gunsan-si, Jeollabuk-do 54007, Republic of Korea
jscheong61@gmail.com

[2] Korea Institute of Science and Technology, Hwarangno 14-gil 5, Seongbuk-gu, Seoul 02792, Republic of Korea, yhshin@kist.re.kr (Corresponding Author)

[3] Gunjang Energy Co., Ltd., Inhaero 333, Gunsan-si, Jeollabuk-do 54007, Republic of Korea
mhkang@gjec.co.kr

Key Words: *Turbulence Scales, Kolmogorov Scales, Cross Diffusion, Near-Wall Turbulence, Low-Reynolds Number.*

Within the context of the constitutive relation between the mean velocity gradients and the Reynolds stresses in turbulence modeling, a velocity and length scale-determining model with a focus on low-Reynolds number and near-wall turbulence is proposed. The scale-determining model behaves for a wall-bounded flow so much like the stadard (K,ω) model in attatched and separated turbulent layers, but as the standard (K,ε) model in viscous sub-layers and free shear layers. For this purpose some functions based on the Kolmogorov velocity and length scales are introduced into the model. The performance of the model is assessed in the framework of a linear eddy viscosity relation for the Reynolds stresses through testing with a planar Couette flow (zero pressure gradient flow), a planar channel flow (favorable pressure gradient flow) and a planar shock-induced separated flow (adverse pressure gradient flow).

Acknowledgment
This research was supported by a grant (code 13IFIP-B065893-05) from the Industrial Facilities & Infrastructure Research Program funded by Ministry of Land, Infrastructure and Transport of the Korean government

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