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**Lattice Boltzmann and Pseudo-Spectral Methods for Decaying Turbulence**<sup>1</sup> LI-SHI LUO, YAN PENG, WEI LIAO, Old Dominion University, LIAN-PING WANG<sup>2</sup>, University of Delaware — We conduct a comparison of the lattice Boltzmann (LB) and the pseudo-spectral (PS) methods for direct numerical simulations (DNS) of the decaying turbulence in a three dimensional periodic cube. We use a mesh size of  $128^3$  and the Taylor micro-scale Reynolds number  $24.35 \leq \text{Re}_\lambda \leq 72.37$ . All simulations are carried out to  $t \approx 30\tau_0$ , where  $\tau_0$  is the turbulence turnover time. We compare instantaneous velocity  $\mathbf{u}$  and vorticity  $\omega$  fields, the total kinetic energy  $K(t)$ , the dissipation rate  $\varepsilon(t)$ , the energy spectrum  $E(k, t)$ , the rms pressure fluctuation  $\delta p(t)$ , the pressure spectrum  $P(k, t)$ , and the skewness  $S_u(t)$  and the flatness  $F_u(t)$  of velocity derivatives. Our results show that the LB method compares well with the PS method in terms of accuracy: the flow fields and all the statistical quantities — except for  $\delta p(t)$  and  $P(k, t)$  — obtained from the two methods agree well with each other when the initial flow field is adequately resolved by both methods. Our results indicate that the resolution requirement for the LB method is  $\eta_0/\delta x \geq 1.0$ , where  $\eta_0$  and  $\delta x$  are the initial Kolmogorov length and the grid spacing, respectively.

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