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Applicability of LES models in capturing turbulence disruption for inertial particle laden turbulent flows[1] NAVEEN ROHILLA, PARTHA S GOSWAMI, PRADEEP MURAMULLA, Indian Institute of Technology Bombay
— Predictingturbulence modulation through DNS at high Reynolds number particle laden turbulent flowsand for a system size of practical interest is almost impossible even with the recent development of high speed computing systems. Therefore, the objective of the present work is to explore the applicability and accuracy of LESin predicting turbulence attenuation. Using DNS, we have recently reportedthat the turbulence intensity decreases with increase in particle loading and at a critical volume loading there is a sudden collapse in turbulence. This happens due to reduction in the turbulent energy production rate [Muramulla et. al., JFM, 2020]. In the present work, we have explored the capability of different LES models to predict the critical volume loading for turbulence collapse at two different Reynolds numbers. It is observed that Smagorinksy and dynamic Smagorinsky models under-predict the critical volume loading at both the Reynolds numbers. However, ADM as a fluid SGS model correctly predicts the critical loading at low Reynolds number. But at high Reynolds number, turbulence collapse is not captured well using ADM model. In all the cases, we found that LES models fail to predict the accurate critical loading due to their inability to capture accurate turbulent production near critical volume fraction.

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