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Evaluation of particle-based flow characteristics using novel Eulerian indices. YOUNGMOON CHO, SEONGWON KANG[1], Sogang Univ — The main objective of this study is to evaluate flow characteristics in complex particle-laden flows efficiently using novel Eulerian indices. For flows with a large number of particles, a Lagrangian approach leads to accurate yet inefficient prediction in many engineering problems. We propose a technique based on Eulerian transport equation and ensemble-averaged particle properties, which enables efficient evaluation of various particle-based flow characteristics such as the residence time, accumulated travel distance, mean radial force, etc. As a verification study, we compare the developed Eulerian indices with those using Lagrangian approaches for laminar flows with and without a swirling motion and density ratio. The results show satisfactory agreement between two approaches. The accumulated travel distance is modified to analyze flow motions inside IC engines and, when applied to flow bench cases, it can predict swirling and tumbling motions successfully. For flows inside a cyclone separator, the mean radial force is applied to predict the separation of particles and is shown to have a high correlation to the separation efficiency for various working conditions. In conclusion, the proposed Eulerian indices are shown to be useful tools to analyze complex particle-based flow characteristics.

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