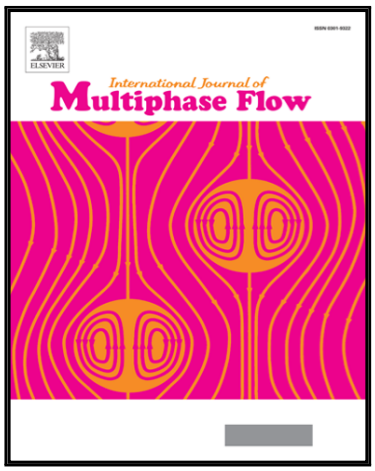


# Modification of particle laden near-wall turbulence in a vertical channel bounded by rough walls.

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**Highlights**

- DNS of particle-laden turbulent channel flows over two irregular rough surfaces have been performed.
- The effect of roughness extends from the near wall into the outer layer.
- Particles damp the spanwise and wall-normal turbulence intensities whereas they enhance the streamwise turbulence.
- Particles reduce the coherence of the near-wall turbulence structures
- A quadrant decomposition of the Reynolds shear stress shows that particles decrease the contributions from strong ejections and sweeps.