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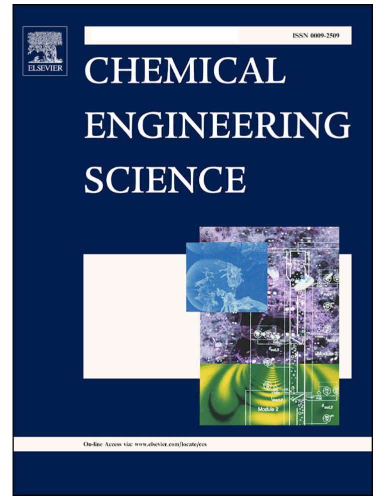


# Continuum prediction of scale-dependent, anisotropic fluctuating kinetic energy in gas-solid flows

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# Continuum prediction of scale-dependent, anisotropic fluctuating kinetic energy in gas-solid flows

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**Abstract**

This note highlights the subtle difference between two measures of fluctuating kinetic energy of the particulate phase in gas-solids flow. One measure arises from kinetic theory, here identified as granular temperature ($T$), and a second measure resulting from a spatial average, here denoted $\kappa$. Somewhat surprisingly, continuum models derived from a kinetic theory considering a single, scalar granular temperature, which is further assumed to be isotropic, is still able to predict anisotropic spatially averaged fluctuating kinetic energies. Furthermore, the scale dependence of the spatially averaged can also be extracted. Comparisons of the continuum predictions to recent direct numerical data are striking, particularly for larger averaging volumes.

*Keywords:* two-fluid model, granular temperature, MFiX, GTSH

Granular temperature, $T$, is a measure of the fluctuating kinetic energy in a particulate phase used in continuum modeling, simulation and experimentation. Different mathematical definitions are often ascribed to granular temperature which can lead to inconsistent comparisons and potentially misleading conclusions. Here, we are specifically concerned with differences between the measure appearing in kinetic theory (KT) derived continuum models related to a probabilistic velocity distribution, e.g., as in Eq. (3) of Goldhirsch [1] or Eq. (4.10) of Garzó et al. [2], and the measure related to an instantaneous spatial average, e.g., as in Eq. (5) of Jung et al. [3] or Eq. (1)

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