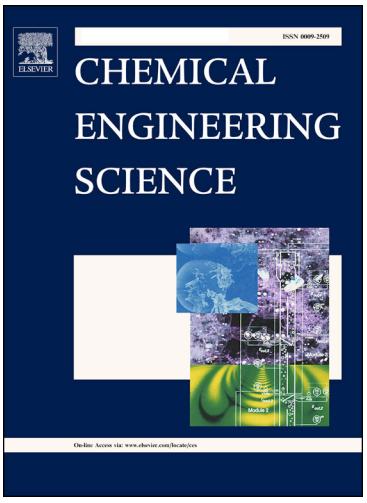

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Scale resolution of fiber optical signals in circulating fluidized bed

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Abstract

The fluidized bed signals can be decomposed into micro-scale, meso-scale and macro-scale by means of multi-resolution analysis, while how to perform the scale resolution accurately and convincingly still lacks appropriate criteria. In this paper, the dual-channel fiber optical signals in the circulating fluidized bed were utilized to investigate the characteristic differences of correlation coefficients and time-delay between three scales. It's found that for two adjacent measurement signals there's good correlation and obvious time-delay at the meso-scale, characterizing the dynamic evolution of cluster structure, while high correlation and no time-delay at the macro-scale (apparatus scale), and no correlation at the micro-scale (discrete particles). Based on such analysis, the correlation time-delay function (CTF) $f_{\tau\text{-}r}$ was put forward as a scale resolution criterion to examine the characteristics of both correlation and time-delay between a pair of signals. Through analyzing the changes of $f_{\tau\text{-}r}$ with the level of decomposition signals, the raw fiber optical signals obtained from a pilot scale circulating fluidized bed (CFB) riser were effectively resolved into three scales.

Keywords: Wavelet analysis; Fiber optical signals; Scale resolution; Fluidization; Correlation time-delay function

Nomenclature

A_j Approximation sub-signal of level j

D_j Detail sub-signal of level j