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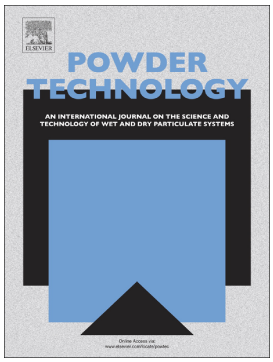

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Stability and Phase Space Analysis of Fluidized-Dense Phase Pneumatic Transport System

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Abstract

Fluidized dense-phase pneumatic conveying of powders is gaining popularity in several industries, such as power, chemical, cement, refinery, alumina, pharmaceutical, limestone etc., because of reduced gas flow rate and power consumption, decreased conveying velocities, improved product quality control, reduced pipeline sizing and wear rate, increased workplace safety etc. However, understanding the fundamental transport mechanism of fluidized dense-phase transport has only made limited progress because of the highly concentrated and turbulent nature of the gas-solids mixture. In the present work, pneumatic conveying trials were conducted with power plant fly ash (median particle diameter: 30 μm; particle density: 2300 kg/m^3; loose-poured bulk density: 700 kg/m^3) through 69 mm I.D. x 168 m long pipeline. The mass momentum and energy balance of the system lead to the formulation of governing equations of flow for the dense-phase pneumatic conveying, which were solved using Runge-Kutta-Fehlberg (RKF45) method for different mass flow rates of fly ash and air. The stability of the system has been established corresponding to the four critical conveying parameters: pressure drop, particle

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