Proceedings of FEDSM'03
4TH ASME_JSME Joint Fluids Engineering Conference
Honolulu, Hawaii, USA, July 6-11, 2003

FEDSM2003-45687

CFD SIMULATION OF SINGLE-PHASE AND DILUTE PARTICULATE TURBULENT FLOWS IN 90° DUCT BENDS

Benny T Kuan **M Philip Schwarz**
Cooperative Research Center for Clean Power from Lignite
CSIRO Division of Minerals, Box 312 Clayton South, Melbourne 3169, Australia
E-mail address: benny.kuan@csiro.au

ABSTRACT

Single-phase and two-phase (gas-solid) turbulent flow calculations are performed for 90° duct bends having radii of curvature ranging from 1.5 to 2.0 duct diameter, and with either a square or circular cross-section. The considered flow Reynolds number is between 6×10^4 and 3×10^5, and the particulate flows examined pertain to two different solid mass loading ratios: 1.5×10^{-4} and 0.33. Numerous turbulence models have been utilized to simulate the turbulent fluid motion within the duct bend while particle trajectories are calculated on the basis of a Lagrangian approach. Reasonable agreement with the experimental data is achieved for the continuous phase in the cases tested. In contrast, significant disparities with the measurements arise in particle tracking calculations, especially in regions where particle rope dispersion is predominant.

Results of this investigation indicate the need for more experimental testing of mill-duct flows of similar configuration in order to facilitate a better understanding and modeling of strongly curved gas-solid duct flows.

Keywords: Particulate flows; Eulerian-Lagrangian numerical simulation; 90° duct bend; Dilute; Mill-duct