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% dep_vel_plus

% clear all
close all
% clc

% Fluid properties and pipe dimensions

M = 28.97; % Molecular weight of air [kg/kmol]
rho_f = 1.16; % fluid density [kg/m^3]
% rho_p = 3750; % aluminium oxide density
rho_p = 2000; % silica colloid density
nu = 1.589*10^-5; % Kinematic visc(v)
mu = nu * rho_f; % Dynamic visc (u)
R = 8314; % Universal gas constant [J/kmolK]
x = 5; % Dynamic shape factor
T = 373; % Fluid temp [Kelvin]

d = 0.1; % Channel diameter / height [metre]
L = 10; % Length of pipe [m]
dx = 5; % Length in which particles travel (minus the initial meter)
S = rho_p/rho_f; % Particle-fluid-ratio

% u = 5; % Avg. velocity, Tandberg
% u = 48.0701; % Avg velocity 50 m/s inlet sim
u = 9.8015; % Avg velocity 10 m/s inlet sim

% Particle diameter
d_p = 5*10^-8; % Particle diameter [metre]
d_p_micro = d_p * 10^6; % Particle diameter [micrometre]

% Development of particle relaxation time

Re_f = (rho_f * u * d)/(mu); % Reynolds number
l = nu * ((pi*M)/(2*R*T))^0.5; % Mean free path
% l = 0.0664 * 10^-6 * (101/101)*(373/293)*((1+(110)/(293))/(1+(110)/(373))); % Crowe
Kn = l ./ d_p; % Knudsen number
Cc = 1 + Kn.*(2.514 + 0.8 .* exp(-0.55./Kn)); % Cunningham slip
correction factor
% Cc = 1 + Kn.*(2.34 + 1.05 .* exp(-0.39./Kn)); % Tandberg, uses
0.5*Kn
Cd = (24/Re_f) * (1+0.15*Re_f^0.687);

% Cf = 0.0791 * Re_f^(-0.25);
Cf = 2 * (2.236*log(Re_f) - 4.639)^(-2); % friction factor
tau_w = Cf * 0.5 * rho_f * u^2; % Wall shear stress
u_fric = sqrt(tau_w / rho_f); % Friction velocity

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tau_p = (rho_p * d_p^2) / (18*mu); % Particle inertia relaxation time
tau_p = tau_p * Cc; % Accounting for rarefied gas effects
tau_plus = tau_p * u_fric^2 / nu % Dimensionless particle realaxation
time

% Computation of dimensionless deposition velocity

Ninn = 100000; % Particles at inlet
Nout = 100000-611; % Particles at outlet

v_dpp = (d*u)/(2*u_fric*dx) * log(Ninn/Nout)

% m_s = (Ninn-Nout)/Ninn; % mass transfer as concentration??

% Sc = nu / (Nout/Ninn);

% fric_vel = 0.2*u/Re_f^(1/8);

% V_dep = m_s / rho_p;
% V_dep_plus = V_dep / fric_vel;

tau_plus =

    0.0011

v_dpp =

    0.0012
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