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Visual C++ 6.0

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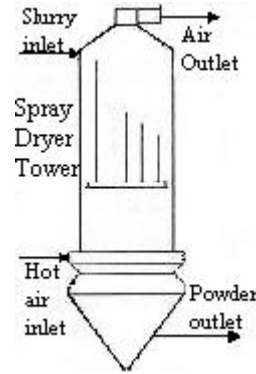
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ton/hr

$d_p$

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) Z=L

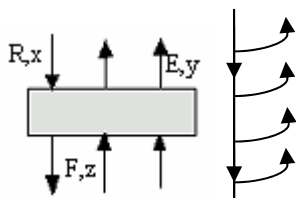
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[ ] [ ]

$$E(1-y)|_{l+dl} - E(1-y)|_l = 0 \Rightarrow$$

$$\frac{d}{dl}(E(1-y)) = 0$$

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: R

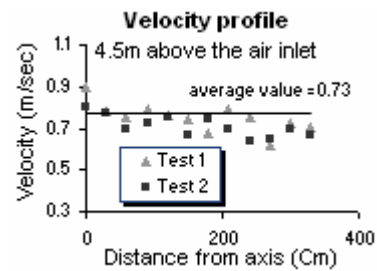
$$R(1-x)|_l - R(1-x)|_{l+dl} - FTR \cdot dl \cdot (1-x) = 0$$

\(\Rightarrow\)

$$\frac{d}{dl}(R(1-x)) = -FTR (1-x)$$

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F



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$$F(1-z)|_{l+dl} - F(1-z)|_l + FTR \cdot dl \cdot (1-x) = 0$$

$$\Rightarrow \frac{d}{dl}(F(1-x)) = -FTR(1-x)$$

$T_s$  و  $T_a$  ،  $z$  ،  $y$  ،  $x$  ،  $F$  ،  $E$  ،  $R$

[ ]R

$$R.x|_l - R.x|_{l+dl} - FTR \cdot dl \cdot x - N_A \cdot S \cdot dl \cdot (1-\phi) \cdot a \cdot M = 0$$

$$\Rightarrow \frac{d}{dl}(R.x) = -(FTR \cdot x + N_A \cdot S \cdot (1-\phi) \cdot a \cdot M)$$

يك

$N_A$  ،  $N'_A$

F

h و FTR

$$F.z|_{l+dl} - F.z|_l + FTR \cdot dl \cdot x - N'_A \cdot S \cdot dl \cdot (1-\phi') \cdot a' \cdot M = 0$$

$$\Rightarrow \frac{d}{dl}(F.z) = FTR \cdot x - N'_A \cdot S \cdot (1-\phi') \cdot a' \cdot M$$

F R

FTR  $N_A$   $N'_A$

h

$$E.y|_{l+dl} - E.y|_l + N_A \cdot S \cdot dl \cdot (1-\phi) \cdot a \cdot M + N'_A \cdot S \cdot dl \cdot (1-\phi') \cdot a' \cdot M = 0$$

$$\Rightarrow \frac{d}{dl}(E.y) = -S.M \cdot (N_A \cdot (1-\phi) \cdot a + N'_A \cdot (1-\phi') \cdot a')$$

$N'_A$

$N_A$   $N'_A$

$N_A$

h .

$$E.C_{Pa}(T_a - T_0)|_{l+dl} - (E - [N_A \cdot (1-\phi) \cdot a + N'_A \cdot (1-\phi') \cdot a'] \cdot S \cdot dl \cdot M) \cdot C_{Pa}(T_a - T_0)|_l = h \cdot S \cdot dl \cdot (1-\phi) \cdot a \cdot (T_a - T_s)$$

$$E \gg [N_A \cdot (1-\phi) \cdot a + N'_A \cdot (1-\phi') \cdot a'] \cdot S \cdot dl \cdot M$$

$$\Rightarrow \frac{d}{dl}(E.C_{Pa}(T_a - T_0)) = h \cdot S \cdot a \cdot (1-\phi) \cdot (T_a - T_s)$$

[ ]

$N_A$

$$F.C_{Ps}(T_a - T_0)|_{l+dl} - F.C_{Ps}(T_a - T_0)|_l + R.C_{Ps}(T_s - T_0)|_l - R.C_{Ps}(T_s - T_0)|_{l+dl} + E.C_{Pa}(T_a - T_0)|_{l+dl} - E.C_{Pa}(T_a - T_0)|_l = 0$$

$$\Rightarrow \frac{d}{dl}(F.C_{Ps}(T_a - T_0)) - \frac{d}{dl}(R.C_{Ps}(T_s - T_0)) +$$

$N_A$

(  $N_A = N_A|_{r=R_p}$  )

$$\frac{d}{dl}(E.C_{Pa}(T_a - T_0)) = 0$$

$$N_A = \frac{C \cdot D_e \cdot R_h \cdot R_p}{(R_p - R_h) r^2} (x_A^* - Y) = f(r)$$

( )

$$r \cdot N_A$$

$$N_A = N_A|_{r=R_p}$$

$$N_A|_{r=R_p} = \frac{C \cdot D_e \cdot R_h}{(R_p - R_h) \cdot R_p} (x_A^* - Y)$$

( )

$$T_S \quad C \quad x_A^*$$

$D_e$

$K \quad R_h$

$R_h$

منظور از  $R_h$

$x \quad R_h$

$$N_A \quad ( )$$

بیان  $x$

$$x = \frac{m_{hp}}{m_{hp} + m_{dp}}$$

$$\Rightarrow m_{dp} = \frac{(1-x)}{x} m_{hp} \Rightarrow$$

( - )

$$m_{dp} = \frac{(1-x)}{x} (4/3 \pi \cdot R_h^3 \cdot \phi_p \cdot \rho_w)$$

( - )

$$m_{dp} \quad - \quad R_h$$

$$R_h = \sqrt[3]{m_{dp} \frac{x}{(1-x)} \times \frac{3}{4 \pi \phi_p \rho_w}}$$

$$m_{dp} = m_{p0} \times ( - x_0)$$

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پیش

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$$m_{p0} \quad ($$

R

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"  $x_0$

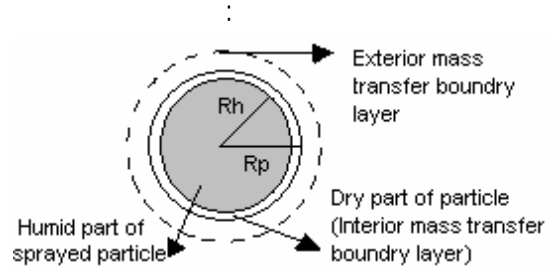
$$( ) L = 0$$

$$\rho_s \cdot 4/3 \pi \cdot R_p^3 = m_{p0}$$

( )

[ ]  
F R

( ) A



$$N_A \cdot A_r|_r - N_A \cdot A_r|_{r+dr} = 0$$

$$\frac{d}{dr} (4\pi r^2 \cdot N_A) = 0 \Rightarrow \frac{d}{dr} (r^2 N_A) = 0$$

( )

$$\Rightarrow r^2 \cdot N_A = K_1$$

( )

$$N_A = -C \cdot D_e \cdot \frac{dx_A}{dr} \Rightarrow$$

( )

$$-C \cdot D_e \cdot \frac{dx_A}{dr} = \frac{K_1}{r^2}$$

( )

$$x_A = Y \quad @ \quad r = R_p :$$

$$x_A = x_A^* \quad @ \quad r = R_h :$$

) Y/K  $x_A$

(

$T_S$

$$C \cdot D_e \cdot x_A = \frac{K_1}{r} + K_2$$

$$\Rightarrow K_1 = \frac{C \cdot D_e \cdot R_h \cdot R_p}{(R_h - R_p)} (Y - x_A^*)$$

( )

رای سایر پارامتر های مجهول نظیر  $De$  و  $Nu$  نیز مورد استفاده قرار می گیرد.

$(\rho_s)$

$(x_0)$

$N'_A$

$R_p$

$m_{dp}$

$R_p$

( )

$x_A$  ( - - )

$z_A^*$   $x_A^*$

$z$   $x$

$z_A$

$D_e$

$R'_p$   $R_p$

$T_a$

$z_A^*$

**FTR**

**F** **R**

$$D_{AB} = a.T_S^b$$

( )

dl

b / Knudsen

b a

[ ]

F

( )

$$u_t = u_{Powder} - u_{air}$$

( )

$\varepsilon_p$

$D_{AB}$

$u_t$

[ ] / - /

$$u_t = \sqrt{\frac{4d_p \cdot (\rho_p - \rho)g}{3C_d \cdot \rho}}$$

( )

برای

$\tau$

$D_{AB}$

tortuosity یا پیچ مسیراست

$\bar{I}$

[ ]

$u_{Powder}$   $u_{air}$

$$u_t = u_{Powdre} - u_{air}$$

$g$   $C_d$   $\rho$  ( )

$\rho_p$

$$D_e = \frac{D_{AB} \cdot \varepsilon_p}{\tau}$$

( )

a

$$D_e = 0.13D_{AB}$$

[ ]

/

( )

یعنی  $m_{dp}$

$m_{hp}$  ( - )

$\rho_p$

$Y$  و  $x_A$   $K$  می توان با استفاده

از داده های تجربی موجود سیستم به روش محاسبات معکوس<sup>۵</sup>

$K$

FTR

$$\rho_p = \frac{m_p}{V_p} = \frac{m_{dp} + m_{hp}}{\frac{4}{3}\pi(d_p/2)^3} \quad ( )$$

$$\frac{E \times \rho}{A_t} \quad u_{air} \quad \frac{R \times \rho_p}{A_t} \quad u_{Powder}$$

( )  $u_t$  می آید ( )

$$d_p \quad u_t$$

conical

می کنند

spray sheet

$$d_{fine} \quad F \quad R$$

)

[ ]

( cp

$$d_{fine} \quad l=L$$

$$FTR \quad d_{fine}$$

/ °

FTR

$$l = L \xrightarrow{\text{from eq (21), (22)}} d_{fine} = f(l)$$

$$\text{Mesh } (d_{20}, d_{60}, d_{80}, d_{100}) \xrightarrow{\text{if } d_{fine}=d_i}$$

$$FTR = R \cdot P_i, \text{ otherwise: } FTR = 0$$

[ ]

$$D_{50} = f d^{0.2} V_p^{-0.9} \eta^{0.1} \rho^{-0.5}$$

( )

که در آن  $D_{50}$  قطر متوسط،  $d$  قطر توربین،  $V_p$  سرعت محیطی،  $\eta$  گرانروی مایع، و  $\rho$  چگالی مایع است.

$$d_i \quad P_i \quad P_i$$

( )

FTR

زیرا

F R

bar

( )

( )

$a' \quad a$

( )

$$R'_p \quad R_p$$

$$N'_A \quad N_A$$

bar

Mesh	20	60	80	100	200	270	325
Dia. (mm)	0.84	0.25	0.177	0.149	0.074	0.053	0.044
Per. (%)	17.36	66.92	5.72	5.4	4.3	0.25	0.009

$l=0$

( )

:

تعیین  $D_{AB}$  ( ) b a

( ) - تابعیت

: رینولدز

$$Nu = 2.0 + c.Re^d \quad ( )$$

d c

[ ]

افشانه ای

پیش

a ، b ، c ، d به کونه ای

a ، b ، c ، d

( )

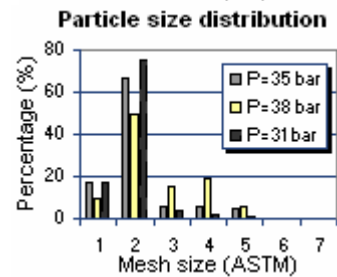
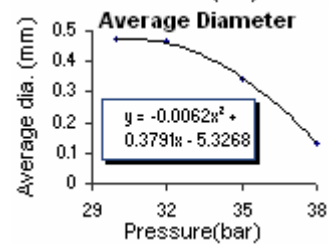
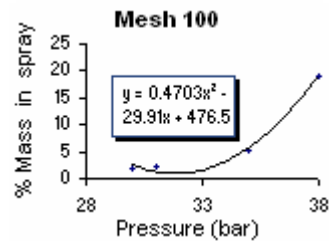
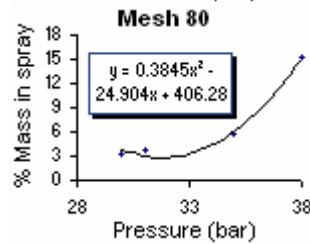
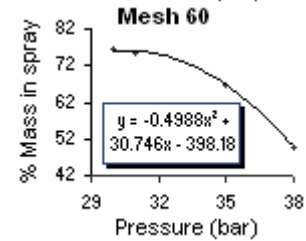
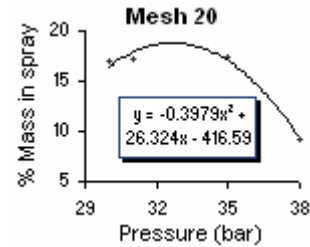
( )

Nu ( ) به نتایج ارائه شده Re

$$Nu = 2 + 1.09Re^{0.74}$$

: T  $D_{AB}$

$$D_{AB} = 1.84 \times 10^{-5} T^{1.67}$$

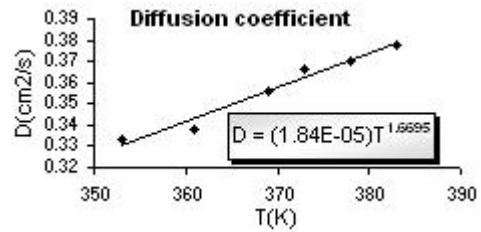
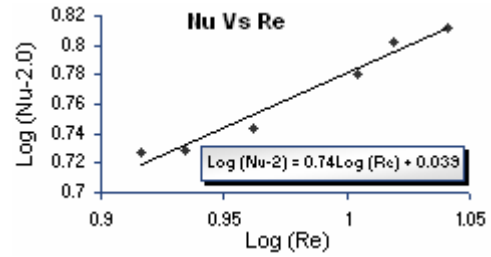




$$K \quad T$$

$$cm^2 / sec$$

$$[ ] \quad [ ]$$



( )

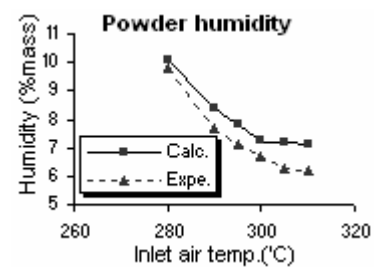
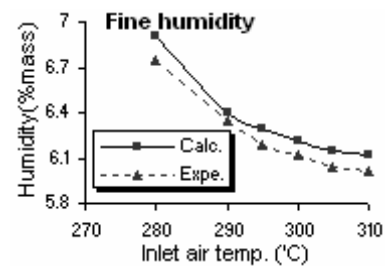
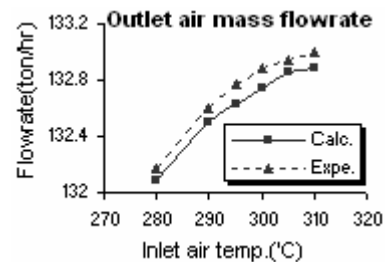
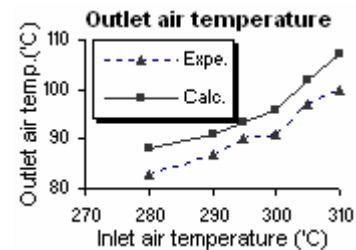
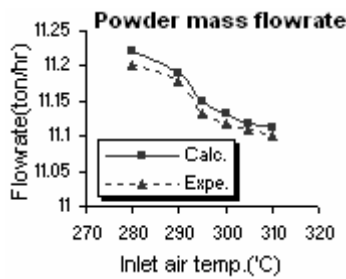
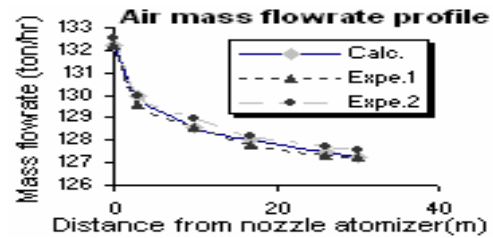
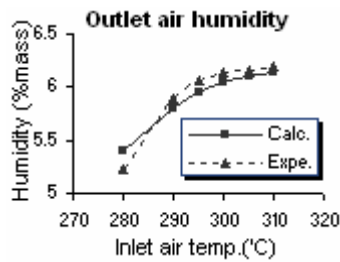
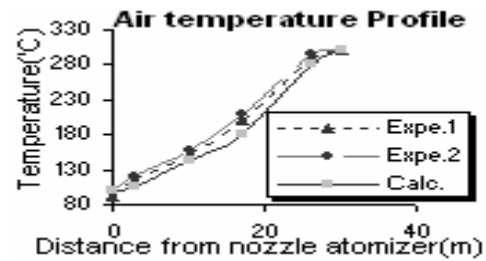
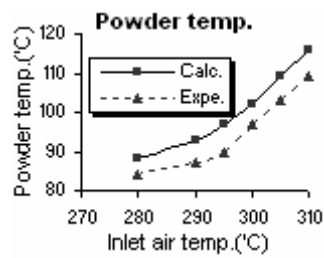
$$\dot{m}_{slurry} = 18000 \text{ kg/hr} \quad \dot{m}_{air}|_{Down} = 127250 \text{ Kg/hr}$$

$$T_{Slurry} = 79 \text{ }^\circ\text{C} \quad T_a|_{down} = 300 \text{ }^\circ\text{C} \quad Z|_{Down} = 0$$

$$F|_{Down} = 0 \quad y|_{Down} = 0.011 \quad x|_{top} = 0.4$$

$$D_{AB} \quad Nu$$

Tower location	Test	Temp. (°C)		Humidity (mass %)			Flow rate (ton/hr)		
		air	slurry/powder	Air	Fine	Slurry/powder	air	slurry/powder	fine
Top	1	93	78	6.59	6.2	40	112.700	18.000	475
Down	1	297	110	1.15	-	8.5	106.500	12.540	-
Top	2	90	79	6.5	6.5	40	116.257	18.000	520
Down	2	295	108	1.21	-	8.1	110.000	12.480	-
Top	3	101	78	6.66	6	40	114.300	18.000	490
Down	3	306	114	1.15	-	7.1	108.000	12.500	-
Top	4	92	75	6.13	6.2	40	118.230	18.000	540
Down	4	290	104	1.2	-	8.3	112.000	11.225	-
Top	5	82	72	6.24	6.9	40	115.100	18.000	500
Down	5	272	98	0.99	-	9.3	109.000	11.390	-



میزان تطابق نتایج محاسباتی با داده های تجربی قابل قبول و همواره کمتر از ۱۰٪ می باشد که این مطابقت را می توان موید درستی مدل سازی تلقی نمود.

%

بنابراین

ذرات ریز

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	$[kg/m^3]$	:	$\rho_P$		
	$[kg/m^3]$	:	$\rho_S$		
	$[^\circ C]$	:	$T_S$		
	$[^\circ C]$	:	$T_a$		FTR
	$[J/kg \cdot ^\circ C]$	:	$C_{Ps}$		
	$[J/kg \cdot ^\circ C]$	:	$C_{Pa}$		$(D_{AB} \quad NU \quad )$
	$[^\circ C]$	:	$T_0$		
	$W/m^2 \cdot ^\circ C$	:	$h$		
	$[m]$	:	$R_P$		
		:	$R_h$		
	$[m]$	:	$d_{fine}$		
R	$[m]$	:	F		
	$[m/s]$	:	$u_t$		
	$[m/s]$	:	$u_{air}$		
	$[m/s]$	:	$u_{Powder}$		
	$[m^2/s]$	:	g	$[kg/hr]$	: E
		:	C	$[kg/hr]$	: R
	$[mol/m^3]$	:		$[kg/hr]$	: F
	$[m^2/s]$	:	$D_{AB}$		: y
		:	$D_e$		: Y
	$[m^2/s]$	:	$C_d$		: x
		:	$A_r$		: z
		:	سطح انتقال جرم برای جزء دیفرانسیلی ذره پاشیده شده $[m^2]$		: $N_A$
	$[kg]$	:	$m_{hp}$		$[mol/m^2 \cdot hr]$
	$[kg]$	:	$m_{dp}$		: $N'_A$
		:	$m_{P0}$	$[m^2]$	$[mol/m^2 \cdot hr]$
		:	$x_A$		: S
		:			: a
		:			$[m^2/m^3]$
		:			: a'
		:	$x_A^*$		$[m^2/m^3]$
		:	کسر مولی اشباع در هر شعاع از درون ذره پاشیده شده		: $\phi$
		:	K		: $\phi'$
		:	ضریب تعادلی در فصل مشترک رطوبت داخل ذره با رطوبت هوای محیط		: $\phi_P$
	$[kg]$	:	$m_p$		: M
	$[m^3]$	:	$V_p$	$[kg/m^3]$	: $\rho_W$
		:		$[kg/m^3]$	: $\rho$

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$p$ : چگالی مایع داخل افشانک [gr/cm <sup>3</sup> ]	( )	$d_i$ :
$Nu$ :		[m]
$Re$ :		$P_i$ : درصد فراوانی هریک از اندازه مش ها
$FTR$ :		$D_{50}$ : قطر متوسط [mm]
[kg/m.hr]		$d$ : قطر توربین [mm]
		$V_p$ : سرعت محیطی [cm/s]
		$\eta$ : گرانروی مایع داخل افشانکهای پاشش [gr/cm.s]

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