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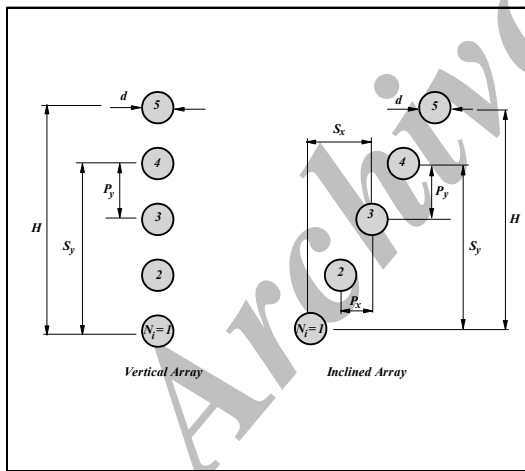
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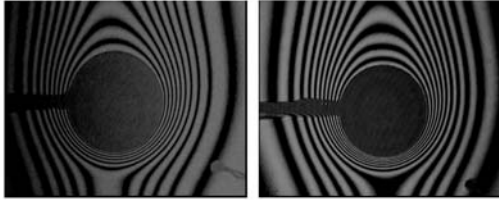
[ ]

$$\begin{matrix}
 i & d & P_y & P_x \\
 N_i & S_y & S_x & H \\
 & & P_x/d & P_y/d
 \end{matrix}$$

[ ]

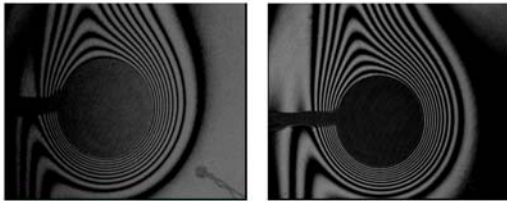
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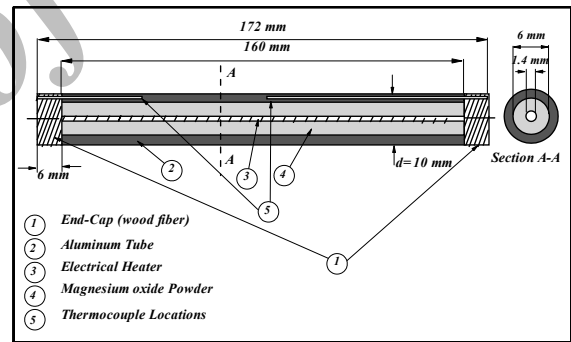
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( ) ( )  $Ra = 3 \times 10^3$

$P_x/d=1$  ( ) ( )  $P_y/d=2$

$P_y/d=2$



[ ]

( )

$$h_{\theta} = -k_w \frac{dT}{dr} \Big|_{r=0} \cdot \frac{l}{(T_w - T_{\infty})}$$

( )

$\theta$

$h_{\theta}$

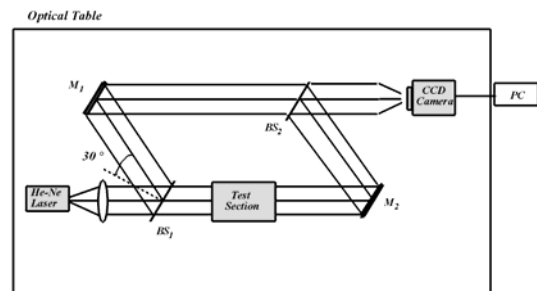
$k_w$

$T_w$

$$Nu_{\theta} = \frac{h_{\theta} d}{k_f} = - \frac{k_w d}{k_f (T_w - T_{\infty})} \cdot \frac{dT}{dr} \Big|_{r=0}$$

( )

mW



$$\nabla \cdot \bar{V}^* = 0$$

$$(\bar{V}^* \cdot \nabla) \bar{V}^* = -\nabla P^* + \nabla^2 \bar{V}^* - \frac{Ra}{Pr} T^* \frac{\bar{g}}{g}$$

$$(\bar{V}^* \cdot \nabla) T^* = \frac{1}{Pr} \nabla^2 T^*$$

$$T_f = k_f$$

$$T_f = \frac{T_w - T_\infty}{2}$$

$$\bar{Nu}_o$$

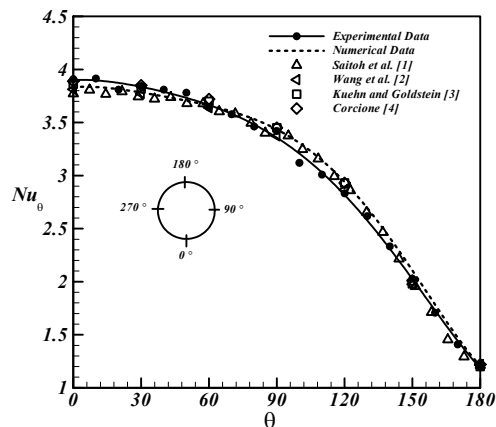
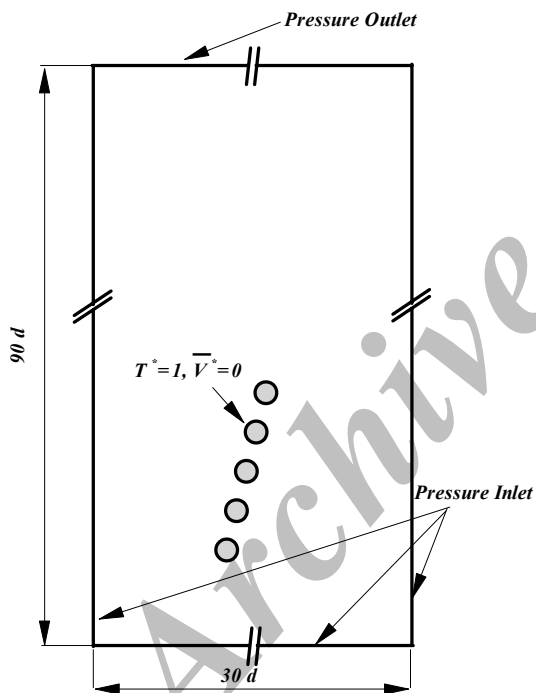
$$\bar{Nu}_o = \frac{1}{2\pi} \int_0^{2\pi} Nu_\theta \cdot d\theta$$

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ASME

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$$T^* \quad v/d \quad V^* \quad U^*$$

$$P^* = \frac{(T_w - T_\infty)}{\rho_\infty v^2 / d^2} \quad ( )$$

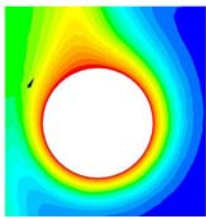
$$Pr = \nu/\alpha \quad Ra = g\beta(T_w - T_\infty)d^3/\nu\alpha$$

( ) ×  $S_y/H$

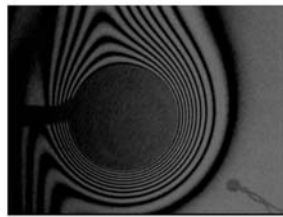
$$\frac{\overline{Nu}_{iv}}{\overline{Nu}_o} = \frac{\overline{Nu}_{iv}}{\overline{Nu}_o} \quad \overline{V}^* = 0 \quad T^* = 1$$

(( ) ) (( ) )

)  $P_y/d=4$   $P_y/d=3$



(ب)



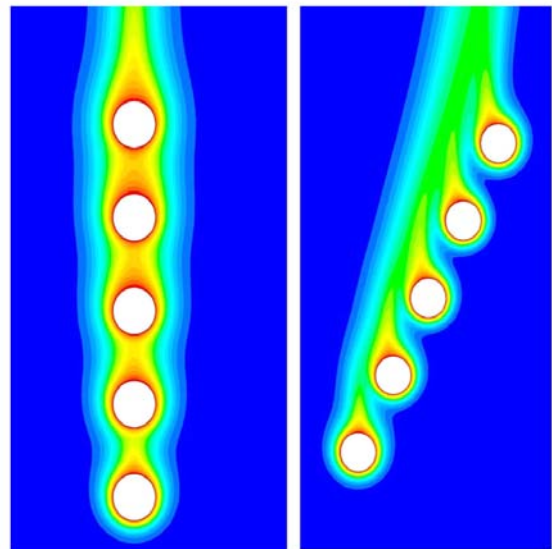
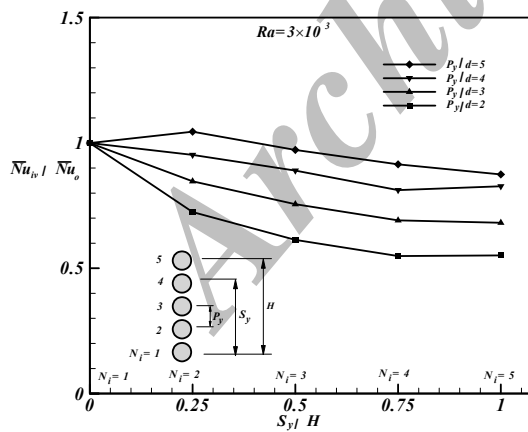
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(.)

$P_x/d=0$   $P_x/d=1$   $P_y/d=2$

( ) ×

( )  $P_x/d=1$   $P_y/d=2$



(ب)

(الف)

$P_y/d=4$   $P_y/d=3$

( ) ×

$P_x/d=0$  ( )  $P_x/d=1$  ( )  $P_y/d=2$

$$0 < P_x/d < 1$$

$$P_x/d > 1$$

$$\theta = 0$$

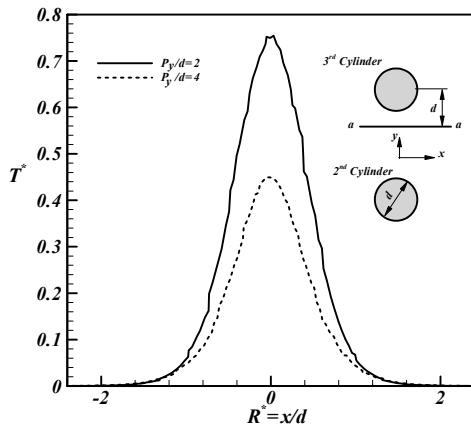
$$P_y/d = 4$$

$$P_y/d = 2$$

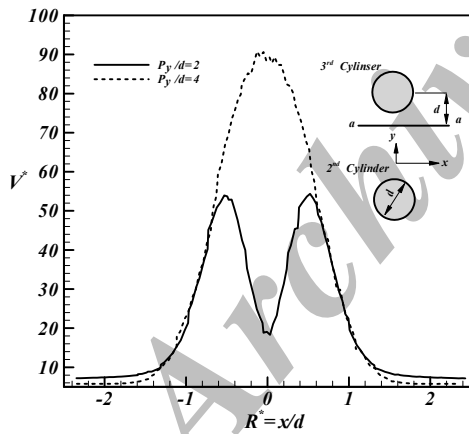
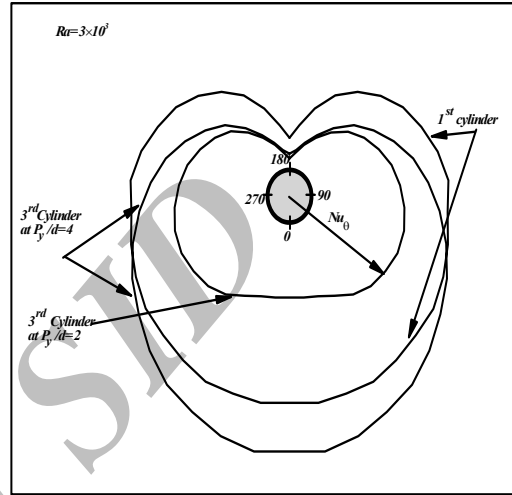
$$P_x/d > 1$$

i

(i+)



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a-a

(( ) )

$$P_x/d$$

)

$$(P_x/d = 0)$$

$$P_x/d$$

( )

( )

( )

$$P_y/d = 2$$

d

a - a

$$P_y/d = 4$$

$$P_y/d = 2$$

×

$$S_y/H$$

( )

$$P_y/d = 2$$

$$\overline{Nu}_{ii} / \overline{Nu}_o$$

$$\overline{Nu}_{ii}$$

$$\overline{Nu}_o$$

i

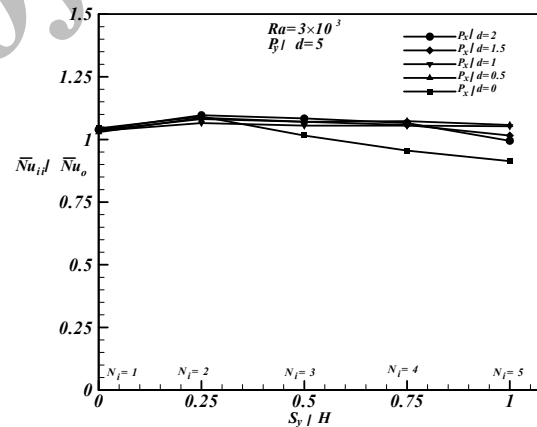
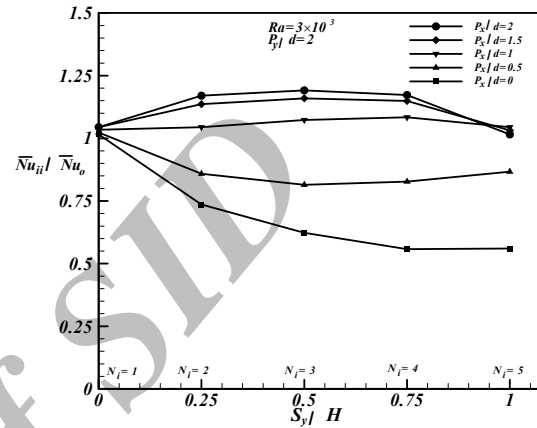
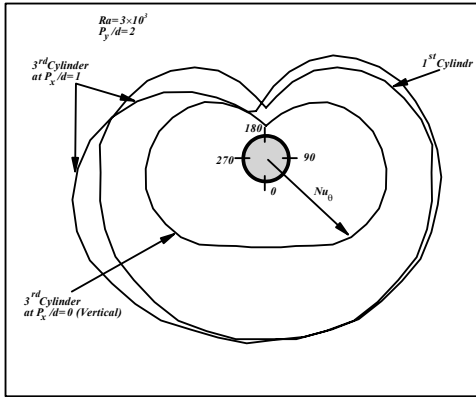
$$P_y/d = 2$$

(( ) )

$$P_x/d=1 \quad P_x/d=0$$

$$P_y/d=2$$

$$P_x/d=1$$



$$P_y/d=5 \quad P_y/d=2$$

- (m) : d
- (m/s<sup>2</sup>) : g
- (m) : H
- (W/m<sup>2</sup>K) : h<sub>0</sub>

i	$S_y$	$(W/m^2 K)$	$k$
	(m)	$(N/m^2)$	$N$
	(K)	$T$	$N_i$
	$T^* = \frac{T - T_\infty}{T_w - T_\infty}$	$i$	$\overline{Nu}_{ii}$
	(m/s) x	$u$	$\overline{Nu}_{iv}$
	(m/s) y	$v$	$\overline{Nu}_o$
			$Nu_\theta$
x	$U^* = \frac{u}{v/d}$	(m)	$P_x$
y	$V^* = \frac{v}{v/d}$	(m)	$P_y$
	$\alpha$	(Pa)	$p$
	$\beta$		$Pr$
	$\gamma$	$P^* = \frac{p}{\rho_\infty v^2 / d^2}$	
	$\theta$	$Ra = g\beta(T_w - T_\infty)d^3 / \nu\alpha$	
	$f$		
	$w$	(m)	$r$
	$\infty$	$i$	$S_x$
			(m)

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