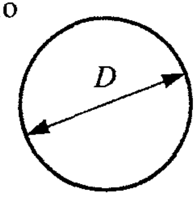
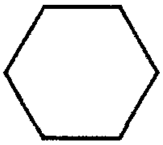
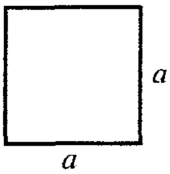
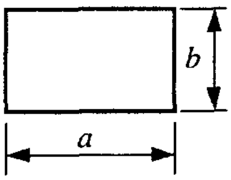
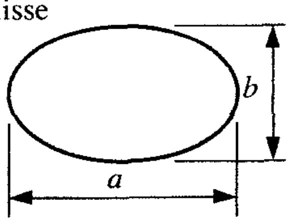
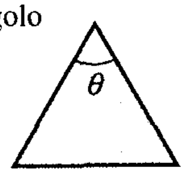
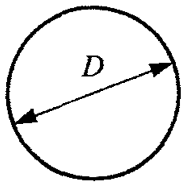
Numero di Nusselt e fattore di attrito per flusso laminare completamente sviluppato in tubi di varie sezioni trasversali ($D_h = 4A_t/p$, $\mathrm{Re} = w_m D_h/\nu$ e $\mathrm{Nu} = hD_h/\lambda$)

Sezione trasversale di tubo	a/b o $\theta°$	Numero di Nusselt	
		T_s = cost	$\dot{q}_s$ = cost
Cerchio 	—	3.66	4.36
Esagono 	—	3.35	4.00
Quadrato 	—	2.98	3.61
Rettangolo 	a/b		
	1	2.98	3.61
	2	3.39	4.12
	3	3.96	4.79
	4	4.44	5.33
	6	5.14	6.05
	8	5.60	6.49
	∞	7.54	8.24
Ellisse 	a/b		
	1	3.66	4.36
	2	3.74	4.56
	4	3.79	4.88
	8	3.72	5.09
	16	3.65	5.18
Triangolo 	θ		
	10°	1.61	2.45
	30°	2.26	2.91
	60°	2.47	3.11
	90°	2.34	2.98
	120°	2.00	2.68

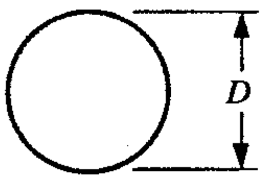
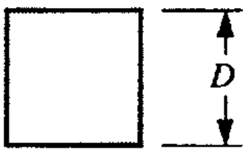
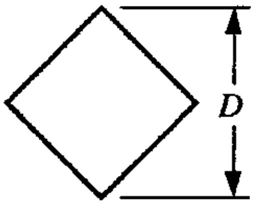
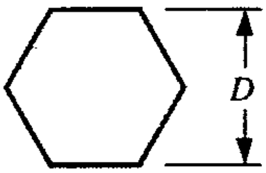
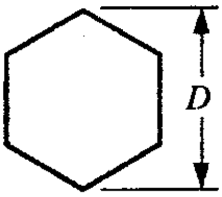
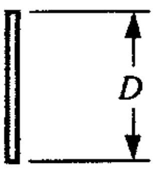
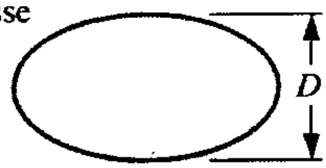
Correlazioni empiriche per il numero di Nusselt per convezione forzata su superfici

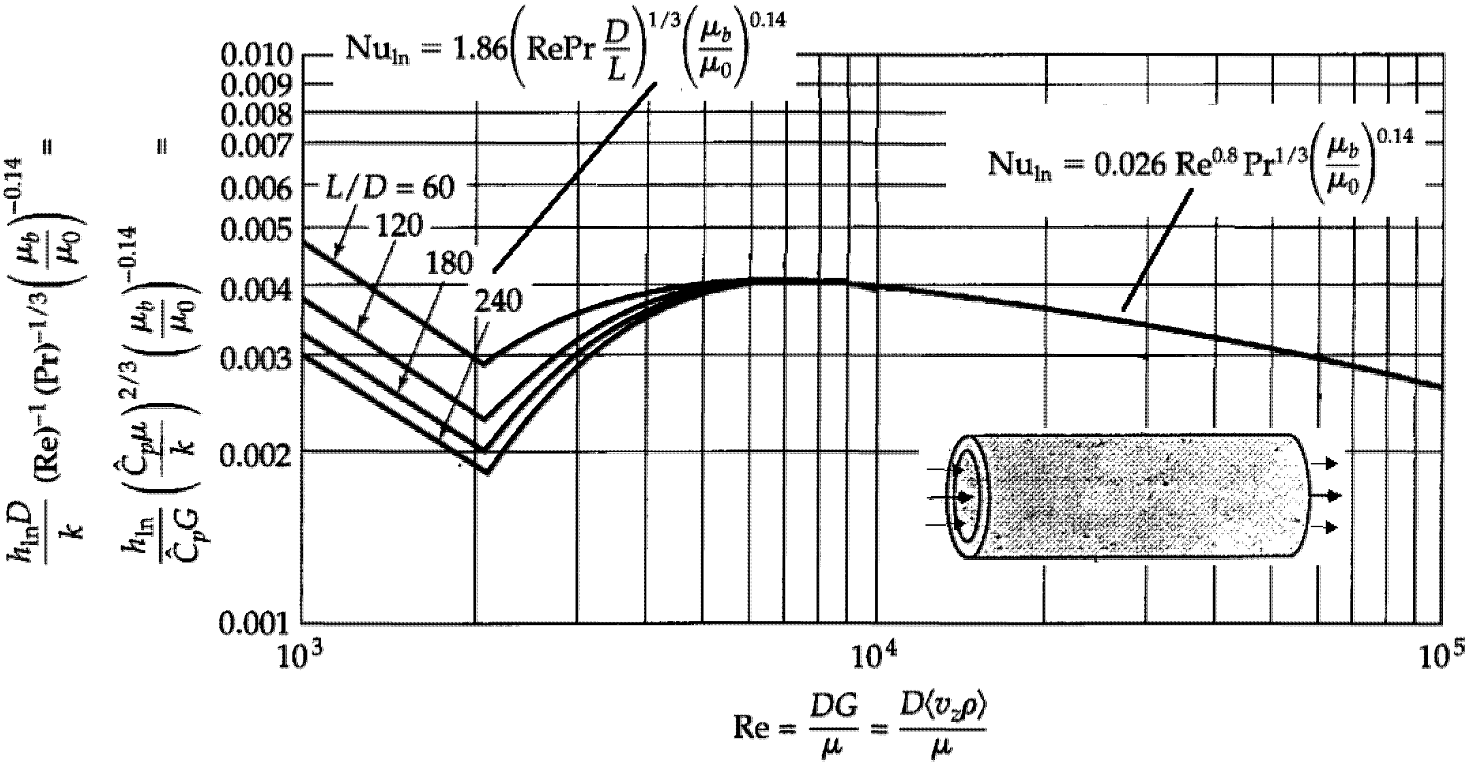
Sfera



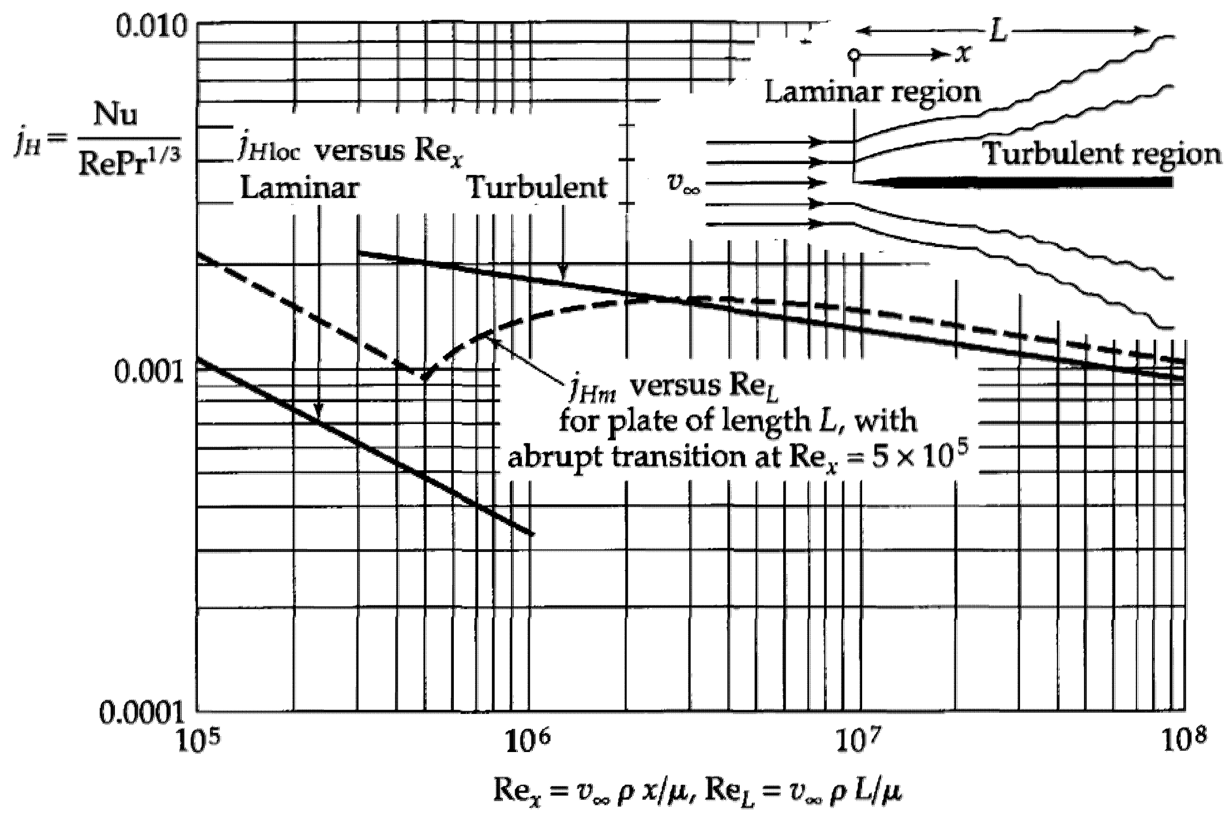
$$\mathrm{Nu}_m = 2 + 0.60\,\mathrm{Re}^{1/2}\,\mathrm{Pr}^{1/3}$$

Correlazioni empiriche per il numero di Nusselt medio per convezione forzata su cilindri circolari e non circolari in flusso trasversale (da Zhukauskas e Jakob)

Sezione trasversale del cilindro	Fluido	Campo di Re	Numero di Nusselt
Cerchio 	Gas o liquido	0.4-4 4-40 40-4000 4000-40 000 40 000-400 000	$Nu = 0.989 Re^{0.330} Pr^{1/3}$ (12-35) $Nu = 0.911 Re^{0.385} Pr^{1/3}$ (12-36) $Nu = 0.683 Re^{0.466} Pr^{1/3}$ (12-37) $Nu = 0.193 Re^{0.618} Pr^{1/3}$ (12-38) $Nu = 0.027 Re^{0.805} Pr^{1/3}$ (12-39)
Quadrato 	Gas	5000-100 000	$Nu = 0.102 Re^{0.675} Pr^{1/3}$ (12-40)
Quadrato (ruotato di 45°) 	Gas	5000-100 000	$Nu = 0.246 Re^{0.588} Pr^{1/3}$ (12-41)
Esagono 	Gas	5000-100 000	$Nu = 0.153 Re^{0.638} Pr^{1/3}$ (12-42)
Esagono (ruotato di 45°) 	Gas	5000-19 500 19 500-100 000	$Nu = 0.160 Re^{0.638} Pr^{1/3}$ (12-43) $Nu = 0.0385 Re^{0.782} Pr^{1/3}$ (12-44)
Lastra verticale 	Gas	4000-15 000	$Nu = 0.228 Re^{0.731} Pr^{1/3}$ (12-45)
Ellisse 	Gas	2500-15 000	$Nu = 0.248 Re^{0.612} Pr^{1/3}$ (12-46)



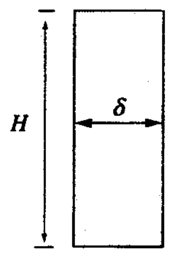
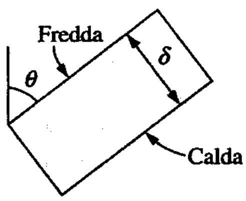
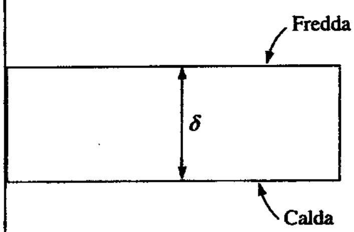
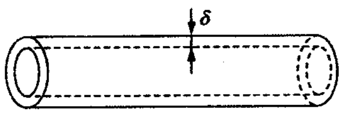
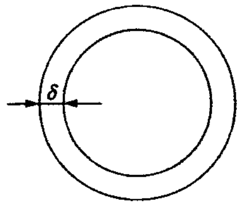
$Nu_{ln} = 1.86\left(RePr\frac{D}{L}\right)^{1/3}\left(\frac{\mu_b}{\mu_0}\right)^{0.14}$
$Nu_{ln} = 0.026\,Re^{0.8}\,Pr^{1/3}\left(\frac{\mu_b}{\mu_0}\right)^{0.14}$
$L/D = 60$
120
180
240
$\frac{h_{ln}D}{k}(Re)^{-1}(Pr)^{-1/3}\left(\frac{\mu_b}{\mu_0}\right)^{-0.14} = \frac{h_{ln}}{\hat{C}_pG}\left(\frac{\hat{C}_p\mu}{k}\right)^{2/3}\left(\frac{\mu_b}{\mu_0}\right)^{-0.14} =$
0.010
0.009
0.008
0.007
0.006
0.005
0.004
0.003
0.002
0.001
10^3
10^4
10^5
$Re = \frac{DG}{\mu} = \frac{D\langle v_z\rho\rangle}{\mu}$



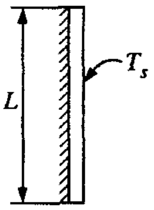
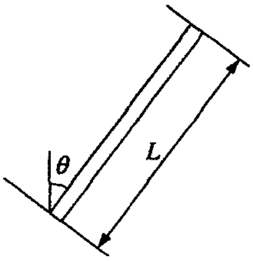
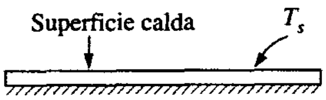
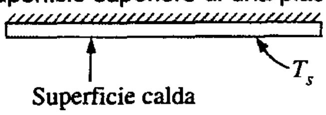
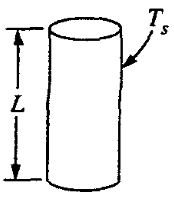
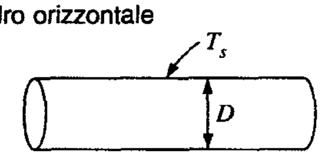
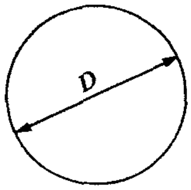
$j_H = \frac{Nu}{RePr^{1/3}}$
j_{Hloc} versus Re_x
Laminar
Turbulent
L
x
Laminar region
Turbulent region
v_∞
j_{Hm} versus Re_L
for plate of length L, with
abrupt transition at $Re_x = 5 \times 10^5$
0.010
0.001
0.0001
10^5
10^6
10^7
10^8
$Re_x = v_\infty \rho x/\mu$, $Re_L = v_\infty \rho L/\mu$

Correlazioni empiriche per il numero di Nusselt per convezione naturale in cavità
(la lunghezza caratteristica δ è indicata nella relativa figura)

$Ra = Gr\ Pr$

Geometria	Fluido	H/δ	Campo di Pr	Campo di Ra	Numero di Nusselt
Cavità rettangolare verticale (o cavità cilindrica verticale)	Gas o liquido	—	—	Ra < 2000	Nu = 1
	Gas	11-42	$0.5 \div 2$	$2 \times 10^3 \div 2 \times 10^5$	$Nu = 0.197\ Ra^{1/4} \left(\frac{H}{\delta}\right)^{-1/9}$
		11-42	$0.5 \div 2$	$2 \times 10^5 \div 10^7$	$Nu = 0.073\ Ra^{1/3} \left(\frac{H}{\delta}\right)^{-1/9}$
	Liquido	10-40	$1 \div 20\,000$	$10^4 \div 10^7$	$Nu = 0.042\ Pr^{0.012} Ra^{1/4} \left(\frac{H}{\delta}\right)^{-0.3}$
		1-40	$1 \div 20$	$10^6 \div 10^9$	$Nu = 0.046\ Ra^{1/3}$
Cavità rettangolare inclinata 					Si usino le correlazioni per le cavità verticali come primo grado di approssimazione per $\theta \leq 20°$ sostituendo g con $g\cos\theta$ nella relazione per Ra
Cavità rettangolare orizzontale (superficie calda in alto)	Gas o liquido	—	—	—	Nu = 1
Cavità rettangolare orizzontale (superficie calda in basso)	Gas o liquido	—	—	Ra < 1700	Nu = 1
	Gas	—	$0.5 \div 2$	$1.7 \times 10^3 \div 7 \times 10^3$	$Nu = 0.059 Ra^{0.4}$
		—	$0.5 \div 2$	$7 \times 10^3 \div 3.2 \times 10^5$	$Nu = 0.212 Ra^{1/4}$
		—	$0.5 \div 2$	$Ra > 3.2 \times 10^5$	$Nu = 0.061 Ra^{1/3}$
	Liquido	—	$1 \div 5000$	$1.7 \times 10^3 \div 6 \times 10^3$	$Nu = 0.012 Ra^{0.6}$
		—	$1 \div 5000$	$6 \times 10^3 \div 3.7 \times 10^4$	$Nu = 0.375 Ra^{0.2}$
		—	$1 \div 20$	$3.7 \times 10^4 \div 10^8$	$Nu = 0.13 Ra^{0.3}$
		—	$1 \div 20$	$Ra > 10^8$	$Nu = 0.057 Ra^{1/3}$
Cilindri orizzontali coassiali 	Gas o liquido	—	$1 \div 5000$ $1 \div 5000$	$6.3 \times 10^3 \div 10^6$ $10^6 \div 10^8$	$Nu = 0.11 Ra^{0.29}$ $Nu = 0.40 Ra^{0.20}$
Sfere concentriche 	Gas o liquido	—	$0.7 \div 4000$	$10^2 \div 10^9$	$Nu = 0.228 Ra^{0.226}$

Correlazioni empiriche per il numero di Nusselt per convezione naturale su superfici **$Ra = Gr\,Pr$**

Geometria	Lunghezza caratteristica δ	Campo di Ra	Numero di Nusselt
Piastra verticale 	L	$10^4 \div 10^9$ $10^9 \div 10^{13}$ Campo intero	$Nu = 0.59\,Ra^{1/4}$ $Nu = 0.1\,Ra^{1/3}$ $Nu = \left\{0.825 + \frac{0.387\,Ra^{1/6}}{[1+(0.492/Pr)^{9/16}]^{8/27}}\right\}^2$ (complessa ma più accurata)
Piastra inclinata 	L		Usare le equazioni della piastra verticale come primo grado di approssimazione Sostituire g con $g \cos\theta$ per $Ra < 10^9$
Piastra orizzontale (Area della superficie A e perimetro p) *a*) Superficie superiore di una piastra calda (o superficie inferiore di una piastra fredda)  *b*) Superficie inferiore di una piastra calda (o superficie superiore di una piastra fredda) 	A/p	$10^4 \div 10^7$ $10^7 \div 10^{11}$ $10^5 \div 10^{11}$	$Nu = 0.54\,Ra^{1/4}$ $Nu = 0.15\,Ra^{1/3}$ $Nu = 0.27\,Ra^{1/4}$
Cilindro verticale 	L		Un cilindro verticale può essere trattato come una piastra verticale quando $D \geq \frac{35L}{Gr^{1/4}}$
Cilindro orizzontale 	D	$10^5 \div 10^{12}$	$Nu = \left\{0.6 + \frac{0.387\,Ra^{1/6}}{[1+(0.559/Pr)^{9/16}]^{8/27}}\right\}^2$
Sfera 	$\frac{1}{2}\pi D$	$Ra \leq 10^{11}$ ($Pr \geq 0.7$)	$Nu = 2 + \frac{0.589\,Ra^{1/4}}{[1+(0.492/Pr)^{9/16}]^{4/9}}$