

Table 7 Analytical Solutions for Heat Conduction in Various Shaped Solids

Shape of Solid	Boundary Conditions	Data Available in Graphs
Semi-infinite. 	Surface temperature suddenly changed.	Temperature distribution in solid as a function of time. References: (4) p. 37; (5) p. V-28; (10) p. 254; (13) p. 46. Heat flow from surface as a function of time. References: (10) pp. 256, 267; (13) p. 47.
	A steady flow of heat is suddenly applied to the surface.	Temperature distribution as a function of time. Reference: (10) p. 257.
	The surface temperature has been varying sinusoidally with time for a long time.	Temperature distribution as a function of time. Reference: (10) p. 296. Heat flow from surface as a function of time. Reference: (10) p. 296.
Semi-infinite with fluid at free surface. 	The temperature of the fluid in contact with the surface has a sudden change. (The surface conductance is constant.)	Temperature distribution as a function of time. References: (4) p. 37; (5) pp. V-45, 46, 47.
	The temperature of the fluid in contact with the surface has been varying sinusoidally with time for a long time. (The surface conductance is constant.)	Temperature distribution as a function of time. Reference: (10) p. 298. Heat flow from the surface as a function of time. Reference: (10) p. 298.
Slab. 	The temperatures t_1 and t_2 are suddenly changed from the initial uniform slab temperature to a new temperature. (The case where the surface on one side is insulated is treated by taking the case of a slab of twice the given thickness since the midplane has no heat flow due to symmetry.)	Temperature distribution as a function of time. References: (5) p. V-12; (10) p. 265.
	The temperatures t_1 and t_2 suddenly begin to increase as linear functions of time. The slab is initially at uniform temperature. (The case where one surface is insulated against heat flow is treated as noted above.)	Temperature distribution as a function of time. Reference: (10) p. 268.
	The temperature at both surfaces has been varying sinusoidally for a long time.	Temperature distribution as a function of time. Reference: (10) p. 300. Heat flow from the surface. Reference: (10) p. 303.

Table 7 Analytical Solutions for Heat Conduction in Various Shaped Solids (Continued)

Shape of Solid	Boundary Conditions	Data Available in Graphs
Slab immersed in a fluid with constant conductance between fluid and slab surface. 	The temperature of the fluid is suddenly changed from the initial uniform slab temperature. (If one surface is insulated against heat flow, see above.) The temperature of the fluid at one surface varies as a periodic function of time while the temperature of the fluid at the other surface is constant. The conductances need not be the same on both sides. (The variations in temperature are expressible as a Fourier series.)	Temperature distribution as a function of time. References: (4) pp. 32, 33, 34, 35; (5) pp. V-9, 10, 35, 42; (10) pp. 274, 284; (13) p. 106. Heat flow from the surface as a function of time. References: (5) p. V-10; (10) p. 274; (13) p. 107. Temperature distribution as a function of time. Reference 14. Heat flow at the surface as a function of time. Reference 14.
Cylinder of infinite axial dimension. 	The surface temperature is suddenly changed from the initial (uniform) temperature. The surface temperature suddenly begins to increase linearly with time.	Temperature distribution as a function of time. Reference: (10) p. 265. Heat flow from surface as a function of time. Multiply temperature difference between surface and fluid by surface conductance. Temperature distribution as a function of time. Reference: (10) p. 269.
Cylinder of infinite axial dimension immersed in a fluid. 	The surrounding fluid suddenly changes from the initial (uniform) temperature of the cylinder. The temperature of the surrounding fluid changes sinusoidally.	Temperature distribution as a function of time. References: (4) p. 36; (5) pp. V-16, V-35, V-43, V-48; (10) pp. 278, 286; (15). Heat flow from the surface as a function of time. References: (5) p. V-16; (10) p. 278. Temperature distribution as a function of time. Reference: (5) p. VI-34. Heat flow from the surface as a function of time. Reference: (5) p. VI-36.
Sphere. 	The temperature of the surface is suddenly changed from the initial uniform temperature. The temperature at the surface suddenly begins to change as a linear function of time.	Temperature distribution as a function of time. References: (5) p. V-23; (10) pp. 264, 265. Temperature distribution as a function of time. Reference: (10) p. 269.