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Note

EMPIRICAL APPROXIMATIONS OF THE THERMAL E.M.F.-TEMPERATURE DEPENDENCE FOR THE STANDARD THERMOCOUPLE 90 Pt–10 Rh/Pt

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Thermal e.m.f. as a function of temperature for the standard thermocouple 90 Pt–10 Rh/Pt is very well approximated by functions of the type t.e.m.f. = At^B, which can be easily inverted.

The dependence of thermal e.m.f. against temperature (°C) for the standard thermocouple 90 Pt–10 Rh/Pt is modelled in I.P.T.S.–68 on the temperature intervals: (−50, 630.74), (630.74, 1064.43), (1064.43, 1665), (1665, 1767.4), using the polynomials of 6, 2, 3 and 3 degree, respectively [1]. This fact makes difficult to invert these functions.

The present note gives some relations of the type t.e.m.f. = $A \cdot t^B$. These functions can be easily inverted.

Table 1 Empirical relationship between the thermal e.m.f. and temperature for the standard thermocouple 90 Pt–10 Rh/Pt*

Temperature interval, °C	$E = At^{B**}$		$t = A_1E^{B_1}$		
	$A \cdot 10^3$	B	A_1	B_1	|ERR.A|
0– 90	4.39	1.07991	152.327	0.9260	<1 °C
90– 850	2.89	1.17274	146.165	0.8527	<1 °C
850–1400	2.33	1.20460	153.115	0.8302	≤1 °C
1400–1600	3.25	1.15870	140.306	0.8630	≤0.7 °C
1600–1750	4.90	1.10320	124.140	0.9065	≤1 °C***

* Reference junction 0 °C.

** E (t.e.m.f.) in mV.

*** Excepting the interval 1740–1750 °C where |ERR.A| ≤ 1.4.

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The parameters for these relations on interval (0, 1750) as well as maximum of the proper absolute error modulus (|ERR.A|) are shown in Table 1.

The importance of these approximations for the automatization of the date processing is visible.

References

1 D. I. Marchidan and M. Ciopec, Temperatura, scări, metode și mijloace de măsurare, Editura științifică și enciclopedică, București, 1977.