As a result of the analysis, a simplified electric model for the instant total voltage U_T (in V) can be written as a function of the measured instant current I (in A) and the measured instant arc length l_A (in mm) in the form

$$U_T(I, l_A) = U_{F0} + R_F I + (E_{z0} + \rho_z I) l_A + (R_{W0} + \rho_W (l_{CTWD} - l_A)) I. \quad (1)$$

l_{CTWD} is the contact tube to workpiece distance (in mm). U_{F0}, R_F, E_{z0}, ρ_z, R_{W0}, and ρ_W are constant parameters summarized in table below.

Table 1: Constants of the electric model

part	constant	unit	value
Electrode fall	U_{F0}	V	13.08
	R_F	Ω	0.0159
Arc column	E_{z0}	V/mm	1.213
	ρ_z	Ω/mm	-2.5 10^{-4}
Free wire	R_{W0}	Ω	5.57 10^{-3}
	ρ_W	Ω/mm	-4.744 10^{-4}

The equation can be rearranged in a way to present the arc length as a function of measured voltage and current:

$$l_A(U_T, I) = \frac{U_T - U_{F0} - (R_F + R_{W0} + \rho_W l_{CTWD}) I}{E_{z0} + (\rho_z - \rho_W) I}. \quad (2)$$