

The proposed combined method for measuring temperature by a trichromatic pyrometer is intended for determining real temperatures of surfaces with the known characteristic $\varepsilon = f(\lambda)$ defining the dependence of the emissivity of the surface on the optical radiation wavelength in the wavelength range of $\lambda \in (\lambda_1, \lambda_3)$. The method implies several measurements of the radiance temperature of the surface and determining the color temperatures by the results of the radiance temperature measurements. The method is distinctive by previously determining the intermediate wavelength (λ_2) at which the corresponding emitting capacity (ε_2) is equal to the arithmetic mean of limit values ε_1 and ε_3 of the emissivity according to the equation $\varepsilon_2 = (\varepsilon_1 + \varepsilon_3)/2$, determining three color temperatures T_{12} , T_{23} , and T_{13} by the results of three measurements of the radiance temperature by using the corresponding equation, and determining the real temperature (T) of the surface by a method of successive approximations using the following equation:

$$T = \frac{1}{T_{i+1}} = \frac{1}{T_{13}} - 2 \frac{\Lambda_{13}}{C_2} \cdot \text{arth} \left\{ \frac{1}{2} \left(\exp \left[\frac{C_2}{\Lambda_{12}} \left(\frac{1}{T_{12}} - \frac{1}{T_i} \right) \right] - \exp \left[\frac{C_2}{\Lambda_{23}} \left(\frac{1}{T_{23}} - \frac{1}{T_i} \right) \right] \right) \right\},$$

where T_i , T_{i+1} are the preceding and following approximate value of the real temperature for each iteration. The first approximate value of the real temperature is determined by the following equation:

$$T_{(1)} = T_{i=1} = T_{23} \cdot T_{12} \cdot (\lambda_3 - \lambda_1) / (\lambda_3 T_{23} - \lambda_1 T_{12}).$$

To determine values ε_1 , ε_2 , ε_3 of the emissivity of the surface, the equation that relates the real temperature to the measured values of the radiance temperature is used.