integral,

$$\varphi(x,t) = \frac{1}{2\pi i} \int_{\gamma-i\infty}^{\gamma+i\infty} \Phi(x,s)\, e^{st}\, ds$$

in the complex s-plane can be used to complete the solution. The integral is evaluated by the method of residues. There is a first-order pole at the origin; other poles are the solution of the transcendental equation

$$\sigma \cos(\ell z_n) \cos(z_n) - \sin(\ell z_n) \sin(z_n) = 0$$

($\sigma \equiv \frac{\Lambda}{\lambda} p$, $\ell \equiv p(\frac{b}{a} - 1)$, $z_n \equiv ia\mu$). There are an infinite number of roots to this equation. For each positive root there is an equal and opposite negative root, however the physical solution corresponds to just positive roots. The result is

$$\varphi(x,t) = 2\sigma \sum_{n=1}^{\infty} \frac{1}{z_n} \frac{[(T_1-T_2)\cos(\ell z_n)+T_2] \cos(z_n \frac{x}{a}) \exp\left(- \frac{kz_n^2 t}{a^2}\right)}{(\lambda+\sigma)\sin(z_n)\cos(\ell z_n)+(1+\lambda\sigma)\sin(\ell z_n)\cos(z_n)}$$

which can be rearranged to

$$\varphi(x,t) =$$

$$2 \sum_{n=1}^{\infty} \frac{1}{z_n} \frac{\sin(z_n)\sin(\ell z_n)[(T_1-T_2)\cos(\ell z_n)+T_2]\cos(z_n \frac{x}{a})\exp\left(- \frac{kz_n^2 t}{a^2}\right)}{\sin(\ell z_n)\cos(\ell z_n) + \ell \sin(z_n) \cos(z_n)}$$

using the eigenvalue equation. The transcendental equation for eigenvalues was solved numerically using the Newton-Raphson method (Booth, 1957). Results were checked graphically to be sure no eigenvalues were missed. For typical computations, 50 terms in the series were computed; convergence of the series is slower for earlier times than later times.