**MATH4564 - HEAT EQUATION No3- Konaté**

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**Heat Equation with Newman Boundary Conditions**

- **3- Newman Homogeneous Boundary Conditions**

Consider the following Heat Problem:

$$\begin{cases} \alpha^2 u_{xx} = u_t \quad 0 \, < \, x \, < \, L \; ; \; t > 0 \\ u_x(0,t) = 0 \quad u_x(L,t) = 0 \quad t > 0 \\ u(x,0) = f(x) \end{cases} \qquad (1).$$

The solution $u(x,t)$ of equation (1) is:

$$\begin{cases} u(x,t) = \frac{c_0}{2} + \sum_{m=1}^{+\infty} c_m e^{\frac{-(m^2\pi^2\alpha^2)t}{L^2}} \cos\frac{m\pi x}{L} \\ c_m = \frac{2}{L}\int_0^L (f(x)) \cos\frac{m\pi x}{L} dx \\ m = 0, \, 1, \, 2, \cdots \end{cases}$$

- $f$ **is considered as an even extension.**
- The quantity $\frac{c_0}{2} = \frac{1}{L}\int_0^L f(x)dx$ is called the Mean distribution of temperature.

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