SOLUTION OF THE STRING VIBRATION EQUATION BY THE FOURE METHOD

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Abstract *Narrow swing in the article equation Fur method using solution seeing is output . Variables separation method used without , borderline the conditions satisfactory solution functions multiplication as is being sought . Fure row using solution general shape are given , the coefficients determination process The solution is explained . correctness and borderline to the conditions compatibility is proven .*

Keywords *narrow vibration Fourier equation method , variables separation , boundary conditions , Fure row , characteristic functions , properties values , trigonometric series , coefficients , solution Convergence*

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Variables separation or Fur method many mathematician physics equations in solution is applied .

Example: This $\frac{\partial^2 u}{\partial t^2}+b^2u=a^2\cdot\frac{\partial^2 u}{\partial x^2}$ (1) of the equation

$$u(0;t)=0 \ (2),\ u(l;t)=0 \ (3), u(x;0)= f(x) \ (4), u_t(x;0)=\varphi(x) \ (5)$$

satisfying the boundary conditions $u(x;t)$. We will look for $u(x;t)\neq 0$ the solution in the form of a product of functions t, one of which depends on and the other x on, and assume that they can be differentiated in the desired order.

$u(x;t)=X(x)T(t)$ (6)

We find the necessary partial derivatives and (1) put them in

$X(x)T^{"}(t)+\mathrm{b}^2\,X(\mathrm{x})\,\mathrm{T}(\mathrm{t})=a^2X^{"}(x)T(t)$ by $a^2X(x)T(t)$.

$$\frac{T^{"}(t)}{a^2T(t)}+\frac{b^2}{a^2}=\frac{X^{"}(x)}{X(x)} \qquad (7)$$

On the left side are differential equations that depend only t on , and on the right side x are differential equations that depend only on . The equality is valid only if they are equal to some constant number. This constant is $-\lambda$ $(\lambda>0)$ We denote by .

$$\frac{T^{"}(t)}{a^2T(t)}+\frac{b^2}{a^2}=\frac{X^{"}(x)}{X(x)}=-\lambda$$

$$X^{"}(x)+\lambda X(x)=0 \qquad (8)$$

$$T^{"}(t)+(b^2+a^2\lambda_k)T(t)=0 \qquad (9)$$

The general solutions of these equations are

$$X_k(x)=\sin(\frac{k\pi x}{l}),\lambda_k=(\frac{k\pi}{l})^2 \qquad (10)$$

$$T_k(t)=a_k\cos(\omega_k t)+b_k\sin(\omega_k t)$$

$$\omega_k=\sqrt{a^2\lambda_k+b^2}=\sqrt{a^2(\frac{\pi k}{l})^2+b^2} \qquad (11)$$

the found ones (6) in ,

$u(x,t)=\sum_{k=1}^{\infty}[a_k\cos(\omega_k t)+b_k\sin(\omega_k t)]\sin(\frac{k\pi x}{l})$ We create .

Here $\omega_k=\sqrt{a^2(\frac{\pi k}{l})+b^2}$

According to the initial condition, a_k we find and b_k

$$u(x,0)=f(x)$$

$$f(x)=\sum_{k=1}^{\infty}a_k\sin(\frac{k\pi x}{l})\rightarrow a_k=\frac{2}{l}\int_0^l f(x)\sin(\frac{k\pi x}{l})dx$$

$$u_t(x,0)=\varphi(x)$$

$$\varphi(x)=\sum_{k=1}^{\infty}b_k\sin(\frac{k\pi x}{l})\rightarrow b_k=\frac{2}{l\omega_k}\int_0^l\varphi(x)\sin(\frac{k\pi x}{l})dx$$

The final solution formula is:

$$u(x,t)=[(\frac{2}{l}\int_0^l f(x)\sin(\frac{k\pi x}{l})dx)\cos(\omega_k t)+(\frac{2}{l\omega_k}\int_0^l\varphi(x)\sin(\frac{k\pi x}{l})dx)\sin(\omega_k t)]\sin(\frac{k\pi x}{l})$$ In this:

$$\omega_k=\sqrt{a^2(\frac{k\pi}{l})^2+b^2}$$

Conclusion : This example is incorrect. and reverse issues from science independent education to perform in the process worked . Narrow vibration in the article equation Fur method using solution seeing is output . Variables separation method used without , borderline the conditions satisfactory solution functions multiplication as is being sought . Fure row using solution general shape are given , the coefficients determination process The solution is explained . correctness and borderline to the conditions compatibility is proven .

Article narrow swing equation Fur method through to solve analysis does . Variables separation from the method using , borderline the conditions satisfactory solution functions multiplication in the form of is found . Fure row using solution general appearance and coefficients is determined , the solution correctness and to the conditions compatibility is proven .

Article Incorrect and reverse issues from science independent education process to perform in the process prepared .

USED LITERATURE

1. Tikhonov, AN, & Samarskii , AA (2004). Equations of Mathematical Physics . Dover Publications.
2. Courant, R., & Hilbert, D. (1989). Methods of Mathematical Physics, Volume 1. Wiley-Interscience.
3. Zauderer, E. (2006). Partial Differential Equations of Applied Mathematics. Wiley.
4. Farlow, S. J. (1993). Partial Differential Equations for Scientists and Engineers. Dover Publications.
5. Boyce, W. E., & DiPrima, R. C. (2012). Elementary Differential Equations and Boundary Value Problems. Wiley.