SECOND IN ORDER PARAMETERIZED PRIVATE DERIVATIVE DIFFERENTIAL EQUATIONS

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ABSTRACT
In this article to the parameter depends private derivative differential equations concept formed. This equations with expressible practical issues and their mathematician models given. Harvest done to the parameter depends private derivative differential the equation parameterized simple differential equation to solve to bring method shown.

Keywords: Parameter, parameterized differential equation, linear equation, narrow, vibration, initial conditional, marginal condition, mathematical model, solution.

It is known that p is a parameter simple and private derivative differential equations separately topic as less studied. The range of problems related to parameters in mathematics is very wide that it is possible to classify them according to the department and topics of science, according to the number of parameters and according to other characteristics about [1,2] thoughts reported. Them some parameterized simple differential equation and them solve methods, solutions to the parameter depends analyses given.

This In the article we parameter depends private derivative differential equations concept we form This equations with expressible practical issues and their mathematician models we bring Harvest done to the parameter depends private derivative differential equations for to be placed some standard issues to be placed we bring.

Private derivative differential in Eqs unknown function argument, itself and private from derivatives except if the parameters are also involved such equations to the parameter depends private derivative differential equations is called For example

$$F(x, y, \mathrm{u}, \frac{\partial u}{\partial x}, \frac{\partial u}{\partial y}, \frac{\partial^2 u}{\partial x^2}, \frac{\partial^2 u}{\partial x \partial y}, \frac{\partial^2 u}{\partial y^2}, a, b, c) = 0 \quad (1)$$

Now

$$A(x, y)\frac{\partial^2 u}{\partial x^2} + 2B(x, y)\frac{\partial^2 u}{\partial x \partial y} + C(x, y)\frac{\partial^2 u}{\partial y^2} + F(x, y, u, \frac{\partial u}{\partial x}, \frac{\partial u}{\partial y}) = f(\mathrm{x}, \mathrm{y}) \quad (2)$$

Let's look at the equation.

This equation is a differential equation with a linear partial derivative with respect to higher-order derivatives with variable coefficients of the second order, and is also called the equations of mathematical physics. Below we formulate this equation as a parametric equation and present some of its types.

$$A(x,y,a,b)\frac{\partial^2 u}{\partial x^2}+2B(x,y,a,b)\frac{\partial^2 u}{\partial x\partial y}+C(x,y,a,b)\frac{\partial^2 u}{\partial y^2}+ \\ +F(x,y,u,\frac{\partial u}{\partial x},\frac{\partial u}{\partial y},a,b)=f(x,y,a,b) \quad (3)$$

the equation is called a differential equation with linear differential equations with respect to higher-order derivatives with two-parameter second-order variable coefficients.

coefficients *A, B, C in the* equation (3) depend only on the parameters *a, b* without depending on the arguments *x, y, it is called an equation with constant coefficients and is written in the following form*

$$A(a,b)\frac{\partial^2 u}{\partial x^2}+2B(a,b)\frac{\partial^2 u}{\partial x\partial y}+C(a,b)\frac{\partial^2 u}{\partial y^2}+ \\ +F(x,y,u,\frac{\partial u}{\partial x},\frac{\partial u}{\partial y},a,b)=f(x,y,a,b) \quad (4)$$

If (4) is the equation one to the parameter depends if _ one parameterized equation is called and his common appearance as follows is written

$$A(a)\frac{\partial^2 u}{\partial x^2}+2B(a)\frac{\partial^2 u}{\partial x\partial y}+C(a)\frac{\partial^2 u}{\partial y^2}+F(x,y,u,\frac{\partial u}{\partial x},\frac{\partial u}{\partial y},a)=f(x,y,a) \quad (5)$$

It is known [3,4,5],

$$A(dy)^2-2Bdxdy+C(dx)^2=0 \quad (6)$$

equation is called a characteristic equation for differential equations with second order higher order derivatives that are linear with respect to the above. Its solutions are called characteristics. Characteristics $\Delta=B^2-AC$ the discriminant to the signs depends. Discriminant expression (3) is equation for *x, y are* arguments and depends on parameters *a, b,* for equation (4) depends on parameters *a, b,* and for equation (5) depends on parameter *a.*

certain set of parameters $\Delta>0$ *a* and *b* in the equation if, (4) is a hyperbolic equation, $\Delta=0$ if parabolic If the $\Delta<0$ equation elliptical equation is called

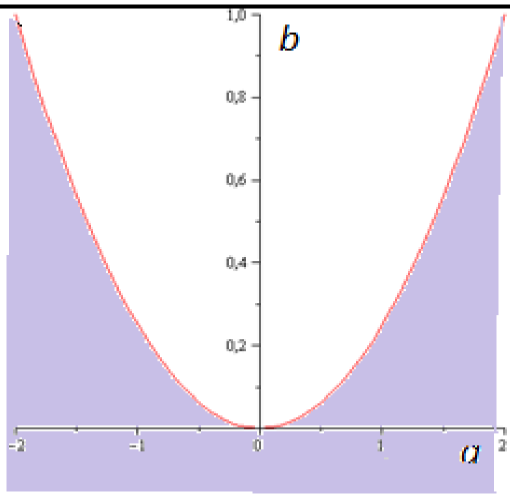
So so, (4) - visible two parameterized for differential equations with particular derivatives, it is possible to ask questions about determining its type.

An example. Determine for what values of parameters *a* and *b* the following equation is a hyperbolic equation.

$$\frac{\partial^2 u}{\partial x^2}+a\frac{\partial^2 u}{\partial x\partial y}+b\frac{\partial^2 u}{\partial y^2}+F(x,y,u,\frac{\partial u}{\partial x},\frac{\partial u}{\partial y},a,b)=f(x,y,a,b)$$

Given equation hyperbolic to be for $\Delta=\frac{a^2}{4}-b>0$ or $b<\frac{1}{4}a^2$ to be need _

set of parameters *a* and *b in* this relation on the plane of coordinates *a* O *b, the set of points (a, b*) consists of points below the following parabola.



If a one-parameter differential differential equation of the form (5) is given, the set of values of the parameter *a affecting its type* consists of sums in the set of real numbers, which are empty, finite, and infinite. can be.

An example. The following equation is hyperbolic, parabolic and elliptic at what values of parameter *a ?*

$$\frac{\partial^2 u}{\partial x^2} + a\frac{\partial^2 u}{\partial x \partial y} + (\frac{3}{4}a+1)\frac{\partial^2 u}{\partial y^2} + F(x,y,u,\frac{\partial u}{\partial x},\frac{\partial u}{\partial y},a) = f(x,y,a)$$

Given equation hyperbolic to be for $\Delta = \frac{a^2}{4} - \frac{3}{4}a - 1 > 0$ or $a^2 - 3a - 4 > 0$ to be need _ So given equation the set of values of the parameter *α which are* hyperbolic, parabolic and elliptical, respectively $(-\infty;-1)\bigcup(4;+\infty)$, $\{-1;4\}$ and $(-1;\ 4)$ from collections consists of will be

Now we show the practical problems expressed by the above parameter specific differential equations. In deriving differential equations representing practical problems, laws of the field to which this practical problem belongs and formulas of mathematics related to the problem are used. The physical, mechanical and geometric quantities related to the problem take part in the established equation and they act as parameters.

As a practical problem, let's consider the problem of narrow vibration [3-5]. Tor is a thin, elastic thread that does not change in length and does not resist changes in shape.

Let us assume that a uniform string of length l equal to is given, and this string is fixed $x=0$ at $x=l$ points. We denote this string by the function that determines its deviation from the equilibrium state $u=u(x,t)$.

Agar densityρ if $\vec{F}(x,t)$ an external force acts on the existing string, then the string starts to vibrate forcibly. This type of vibration of the string is represented by the second-order differential equation of the following form[3-5] :

$$\frac{\partial^2 u}{\partial t^2} = a^2\frac{\partial^2 u}{\partial x^2} + f(x,t) \qquad (7)$$

(7). tighten up mandatory vibration equation is called

Here _ $a=\sqrt{\frac{T}{\rho}}$, T - tighten up combing strength, $f(x,t)=\frac{F(x,t)}{\rho}$, $\rho - const$ if so, it 's a narrow one is called sexual. If the effect doer external strength $F(x,t)=0$ if it is, that is balance from the situation released tor only internal forces under the influence of oscillates, then (7) is appearance from the following consists of will be

$$\frac{\partial^2 u}{\partial t^2}=a^2\frac{\partial^2 u}{\partial x^2} \qquad (8)$$

To this tighten up free vibration equation is called (7), (8) - equations (5)- visible parameterized of Eq private is the case. These equations of parameter *a* from scratch different all in values is hyperbolic.
It is known that equations in general when infinite many p to the solution have _ Clearly one physicist issue the solution to express for (7) and (8). equations enough not _ That's why for this kind of of vibrations full legality determination for equations to the matter suitable coming the beginning and borderline conditions with to look need will be
For example: solutions of equations (7) and (8). so among $u=u(x,t)$ It is necessary to find n so that this solution $t=0$ satisfies the following initial condition

$$u(x,0)=\varphi(x),\quad \frac{\partial u(x,0)}{\partial t}=\psi(x), \qquad (9)$$

Here φ and ψ are optional functions. Of these except borderline taking into account the conditions to get right _ will come If you are shaking of the body ends $x=0$ and $x=l$ at points fixed if, then borderline conditions as follows will be, that is

$$u(0,t)=0,\ u(l,t)=0, \qquad (10)$$

Given private derivative differential equation placed the beginning and borderline conditions with together of the matter mathematician model is called

Mathematician physics equations for placed issues of solving Dalamber, Fere and another one how much methods existence [3-5]. Of these one sure for one issue let 's show.

$$\frac{\partial^2 u}{\partial t^2}=a^2\frac{\partial^2 u}{\partial x^2},$$

$$u(x,0)=\varphi(x),\ \frac{\partial u(x,0)}{\partial t}=\psi(x)$$

This is a matter of tension free vibration equation for Koshi issue is called This issue Dalamber method with found common the solution as follows [3-5]

$$u(x,t)=f_1(x+at)+f_2(x-at)$$

Primary conditions satisfactory private the solution while

$$u(x,t)=\frac{\phi(x+at)+\phi(x-at)}{2}+\frac{1}{2a}\int_{x-at}^{x+at}\psi(\tau)d\tau.$$

Apparently _ as it is common the solution is also private the solution is also to the parameter *a* without expressed. The parameter change to the solution amount and quality in terms of effect to do can _

Some parameterized private derivative differential equations variable replacement method with common the solution to the parameter depends appearance _ to find can _ For example, this one three parameterized the equation I'm blind

$$\frac{\partial^2 u}{\partial x \partial y} + a\frac{\partial u}{\partial x} + в\frac{\partial u}{\partial y} + cu = 0.$$

$u(x,y) = e^{-вx-ay}\cdot\vartheta(x,y)$ that replacement we do, then

$$\frac{\partial u}{\partial x} = -вe^{-вx-ay}\cdot\vartheta + e^{-вx-ay}\cdot\frac{\partial\vartheta}{\partial x}.$$

These given to Eq let's put and let's simplify :

$$aв\vartheta - в\frac{\partial\vartheta}{\partial y} - a\frac{\partial\vartheta}{\partial x} + \frac{\partial^2\vartheta}{\partial x\partial y} - aв\vartheta + a\frac{\partial\vartheta}{\partial x} - aв\vartheta + в\frac{\partial\vartheta}{\partial y} + c\vartheta = 0;$$

$$\frac{\partial^2\vartheta}{\partial\xi\partial\eta} + (c - aв)\vartheta(\xi,\eta) = 0.$$

This two times let's integrate

$$\frac{\partial\vartheta}{\partial\eta} = (aв - c)\int_0^{\xi}\vartheta(\tau,\eta)d\tau + \psi(\eta),\ \vartheta(\xi,\eta) = (aв - c)\int_0^{\xi}\vartheta(\xi,z)d\tau dz + \int_0^{\eta}\psi(z)dz + \varphi_1(\xi),$$

$$\vartheta(\xi,\eta) = (aв - c)\int_0^{\xi}\int_0^{\eta}\vartheta(\tau,z)dzd\tau + \varphi_1(\xi) + \varphi_2(\eta),$$ this on the ground $\phi_2(\eta) = \int_0^{\eta}\psi(z)dz.$

To this basically given the equation to parameters depends common the solution

$$u(x,y) = e^{-в-ay}\vartheta(x,y) = e^{-в-ay}\left[(aв - c)\int_0^{x}\int_0^{y}\vartheta(\tau,z)d\tau dz + \varphi_1(x) + \varphi_2(y)\right]$$ will be _

It 's here φ_1 and φ_2 s second in order differentiable functions.

Narrow swing one parameterized without a line of Eq common The appearance is as follows to Eq it is said

$$Lu \equiv u_{tt} - u_{xx} = g(u,a) + f(x,t,a) \qquad (11)$$

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