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Differential Game Problem with Solving Functions

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Abstract. *In this article, an important part of mathematical control theory one of the directions in the theory of differential games pursuit-evasion problems were posed in simple differential games with constraints. Pursuit problem and escape problems were solved. Solution of the capture problem by the theorem is proven.*

Key words: *Differential game, geometric constraint, pursuit problem, escape problem, parallel pursuit strategy, catch problem.*

Differential equations physics, mechanics, differential geometry, variational in such disciplines as mathematics, heat engineering, electrical engineering, chemistry, biology, and economics is applied. Many of the processes encountered in these disciplines are differential equations is described by. With the study of these equations, something about the corresponding processes We gain information and understanding. Characteristic quantities and their derivatives or It is easy to find the relationship between the differentials.

Ordinary differential equation - the relationship between an unknown function and its derivatives represents a mathematical relation In such equations, there is only one unknown function.

Variational method for solving ordinary differential equations.

Variable methods for solving differential equations and boundary value problems is a powerful mathematical method used. The main goal of this method is a specific goal. Differential equations by minimizing (or maximizing) the function to find solutions.

The main purpose of variational methods is:

1. Equation by minimizing (or maximizing) the integral of a function to find a solution.
2. In this method, by changing the acting parameters, the functional (e.g., the integral) must have the smallest (or largest) value.

Using the following ordinary differential equation and its variational method as an example.

Let's consider the solution:

We introduce the following definitions: Definition: D(R) —t C— to reflect P(R) where C is the field of complex numbers ip e D(R) function value (/, (p) is designated by. By definition (/, V’) if equality holds, f: D(R) -» C functional is called linear.

Variable methods for solving differential equations and boundary value problems is one of the most effective and convenient methods. Euler-Lagrange equations, the Galerkin method, and other methods are used to find solutions using these methods. These are programs like Maple helps in the practical application of methods and allows automation of calculations.

The Maple program window is like the window of all application programs. Maple's worker is divided into 3 parts:

1. The input field consists of a command line. Each command line > symbol starts with;
2. Output field - formed after processing the entered commands data (analytical expressions, graphs, and messages);
3. Text comments field - comments on errors or executed commands, messages of varying nature One and two, given in explicit, parametric, implicit forms using the Maple program the graphs of functions with variables can be drawn very beautifully.

Differential equations are widely applied in sciences such as physics, mechanics, differential geometry, variational calculus, heat engineering, electrical engineering, chemistry, biology, and economics. Many processes encountered in these disciplines are described by differential equations. By studying these equations, we gain some information and understanding about the related processes.

Differential equations represent a mathematical model of the process being studied.

The more perfect this model is, the more completely the data obtained from studying differential equations describes the processes. Various processes occurring in nature (physical, chemical, biological processes etc.) have their own laws of motion. Some processes may occur according to the same law, which simplifies the task of studying them. However, it is not always possible to directly find the laws describing these processes.

It is naturally easier to find the relationship between characteristic quantities and their derivatives or differentials.

A first-order differential equation is an equation of the form F (x,y,y') = 0 that expresses the relationship between an unknown function y (x) and its first derivative y' (x), which can generally be written as y' = f (x,y). These equations can be solved using various methods, such as separation of variables, homogeneous equations, linear equations, Bernoulli equations, and exact differential equations. First-order differential equations are widely used in mathematical modeling.

Main types: Separable equations: If the equation can be brought to the form \ (g (y) dy=f (x) dx\), it can be solved using this method. Homogeneous equations: If the function \ (f (x,y) \) depends on \ (y/x\), it is reduced to a separable equation using the substitution \ (y=ux\). Linear first-order equations: Equations of the form \ (y^{\prime }+P (x) y=Q (x) \), which can be solved using the integrating factor method. Bernoulli's equation: In the form \ (y^{\prime }+P (x) y=Q (x) y^{n}\), which is reduced to a linear equation through a special substitution. Exact differential equations: In the form \ (M (x,y) dx+N (x,y) dy=0\), which can be solved directly if the condition \ (\frac{\partial M}{\partial y}=\frac{\partial N}{\partial x}\) is satisfied.

Conclusion. Differential equations and boundary value problems theory plays an important role in mathematics and its practical applications. Boundary modern mathematical approaches to solving problems, such as the variational method, are effective results. gives.

This is an equation with separable variables, and now we will integrate both sides of the equation.

$\int y\cos y\, dy = -2\int x dx$

Let's integrate the left side of the equation by parts:

$\int y\cos y\, dy = ?$

$y=u \quad dv=\cos y\, dy$

We find that dy=du, v=siny;

∫ycosydy=ysiny-∫sinydy=ysiny+cosy.

Now we calculate the left side of the equation;

-2∫xdx=-x^2 combining the results:

ysiny+cosy+x^2=C gives us the general solution.

Answer: ysiny+cosy+x^2=C

Example 2: Solve the following differential equation:

y'=cos (y-x) [2].

Here we introduce the notation y-x=t and take the derivative of t with respect to x, considering t as t (x).

As a result, y'=t'+1.

t'+1=cost from here, if we find t',

t'=cost-1 is obtained. This equation has the solution t=2πk, y=x+2πk when cost=0

and the equation satisfies the solution at 0=0.

For t'=dt/dx,

dt/ (cost-1) =dx.

This is an equation with separable variables, and now we will integrate both sides of the equation.

This is an equation with separable variables, and now let both equalities be

Let's integrate the side.

In general, differential equations and their boundary value problems are not only an important part of theoretical mathematics, but also a complex in the fields of science and technology. Also plays an important role in system modeling. This in-depth research and practical developments in the field contribute to solving a number of pressing issues.

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