*COMPUTER SCIENCE*

# AUTOMATED SOLUTION OF PRIVATELY GENERATED NONLINEAR EQUATION OF HEAT CONDUCTION IN MAPLE

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***Abstract.*** *To build accurate solutions to non-linear equations of mathematical physics, a number of methods have been developed based on the transition to new variables (dependent and independent). In this case, the goal is usually set: to find new variables whose number is less than the number of initial ones. Switching to such variables leads to simpler equations. In particular, the search for exact solutions to equations with partial derivatives of two independent variables is reduced to the study of ordinary differential equations (or systems of such equations). Naturally, with this reduction, solutions of ordinary differential equations do not give all solutions of the original equation with partial derivatives, but only a class of solutions that possess some of their own standards. The simplest classes of exact solutions that describe ordinary differential equations are traveling wave type solutions and auto-model solutions. The existence of these solutions is usually (but not always) due to the invariance of the equations considered with respect to shear and stretch-compression. The phenomenon developing in time is called auto-model, the distribution of its characteristics at different points in time is obtained from another similarity transformation. Auto-modeling allows, in many cases, to reduce the problem of mathematical physics to solving conventional differential equations, which significantly simplifies the study. With the help of auto-model solutions, researchers tried to see the characteristic properties of new phenomena. In addition, automatic solutions were used as benchmarks in evaluating approximate methods for solving more complex tasks. modern computer technology has enabled us to automate solutions to these types of problems complicated. The article describes the use of the method using the example of a self-modal solution in the MAPLE program. We use the above and higher order private equation differential equations when solving university management tasks.*
***Keywords:*** *Private Manufactured Differential Equation, Automotive Method, Program, Computer, MAPLE Computer Program.*

**Introduction.** For the exact solution of nonlinear equations in mathematical physics, certain methods have been developed based on the transition procedures to new variables (independent and dependent). At this point we usually aim: to find new variables, in smaller numbers than the original variables. Switching to such variables gives us simpler equations. In particular, the exact solution of two-dimensionally derived differential equations is reduced to the solution of usually differential equations or systems. Clearly during the indicated reduction, the solution of ordinary differential equations does not give us all the solutions of a given private equation, but gives us a class of solutions that has certain properties.

The simplest class of exact solutions obtained by ordinary differential equations is the solution known as the running wave and the automotive solution. The existence of such a solution (of course not always) is due to the invariance of the equations under consideration with respect to the offset and the torsional-compression.

An event that is defined in time is called automotive if the distribution of its characteristics at different points in time is obtained by transforming similarities from one to another. Automotive in various cases allows us to solve the problems of mathematical physics to solve ordinary differential equations, which greatly simplifies research. Autodellar solutions allow the researcher to observe the characteristic features of new events. In addition, automotive solutions are used as benchmarks in evaluating solutions to more complex problems.

Automotive - is the symmetry of tasks that allows us to compensate for large-scale transformations of variables in the form of stretching solutions.

$$u(x,t) = A(t)f(\xi), \qquad \xi = \frac{x}{l(t)}.$$

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If the equation depends on a single space variable, then automotive means solving a new scale of the l (t) coordinate and u (x, t) solving in such a way that the solution in the new coordinates is a function of one ξ variable.

When it is possible to find such a transformation, then this task is reduced to the usual differential equation. Sometimes transformation is easier by analyzing the physical wealth that is included in the equation.

**with(PDETools):**
**with(ODETools);**
**with(plots);**
**PDE := diff(u(x, t), t) = diff(u(x, t)*(diff(u(x, t), x)), x);**

$$\frac{\partial}{\partial t}u(x,t) = \left(\frac{\partial}{\partial x}u(x,t)\right)^2 + u(x,t)\left(\frac{\partial^2}{\partial x^2}u(x,t)\right)$$

**tr := {t = tau, x = xi*tau^(1/3), u(x, t) = f(xi)/tau^(1/3)};**

$$\left\{t = \tau, x = \xi\tau^{\frac{1}{3}}, u(x,t) = \frac{f(\xi}{\tau^{\frac{1}{3}}}\right\}$$

**ODEA := dchange(tr, PDE, simplify);**

$$-\frac{\xi\left(\frac{d}{d\xi}f(\xi)\right) + f(\xi)}{3\tau^{\frac{4}{3}}} = \frac{f(\xi)\left(\frac{d^2}{d\xi^2}f(\xi)\right) + \left(\frac{d}{d\xi}f(\xi)\right)^2}{\tau^{\frac{4}{3}}}$$

**ODE1 := ODEA*tau^(4/3);**

$$-\frac{1}{3}\xi\left(\frac{d}{d\xi}f(\xi)\right) - \frac{1}{3}f(\xi) = f(\xi)\left(\frac{d^2}{d\xi^2}f(\xi)\right) + \left(\frac{d}{d\xi}f(\xi)\right)^2$$

**ODE2 := int(lhs(ODE1)-rhs(ODE1), xi);**

$$-\frac{1}{3}\xi f(\xi) - f(\xi)\left(\frac{d}{d\xi}f(\xi)\right)$$

**ODE3 := dsolve(ODE2);**

**f1 := unapply(rhs(ODE3[2]), xi);**

$$\xi \to -\frac{1}{6}\xi^2 + \_C1$$

**_C1 := solve(int(f1(xi), xi = -sqrt(6*_C1) .. sqrt(6*_C1)) = 1, _C1);**

$$\frac{1}{4}6^{\frac{1}{3}}$$

**SQL := subs({xi = x/t^(1/3), f(xi) = u(x, t)*t^(1/3)}, ODE3[2]);**

$$u(x,t)t^{\frac{1}{3}} = -\frac{x^2}{6t^{\frac{2}{3}}} + \frac{1}{4}6^{\frac{1}{3}}$$

**AMS1 := solve(SQL, u(x, t));**

$$\frac{3(6)^{\frac{1}{3}} t^{\frac{2}{3}} - 2x^2}{12t}$$

**u := unapply(piecewise(x^2/t^(2/3) <= (3/2)*6^(1/3), AMS1, 0), [x, t]);**

$$(x, t) \rightarrow piecewise\left(\frac{x^2}{t^{\frac{2}{3}}} \leq \frac{3(6)^{\frac{1}{3}}}{2}, \frac{3(6)^{\frac{1}{3}} t^{\frac{2}{3}} - 2x^2}{12t}, 0\right)$$

**plot([u(x, 0.1e-1), u(x, 0.2e-1), u(x, .1),**
**u(x, .5)], x = -2 .. 2, y = -0.5e-1 .. 2.5,**
**color = [red, blue, green, black],**
**thickness = 3,**
**labels = ['x', 'u(x, t)'],**
**title = "sitbogamtarobis arawrfivi gantolebis avtomodaluri amoxsna")**

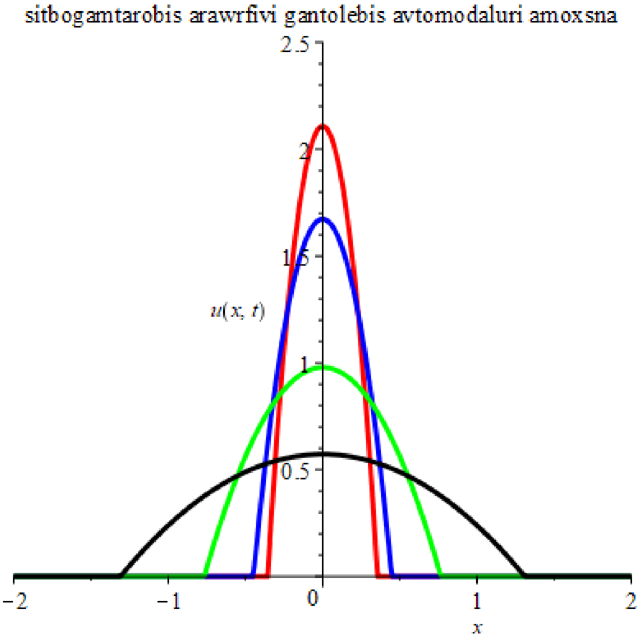


*Fig. 1.*

Performing these types of equations in the Maple program allows the researcher to perform many practical mathematical physics, engineering, and applied tasks.

**Conclusions**. The automotive insertion led us to the fact that instead of the custom-made differential equation, we obtained the ordinary differential equation, which made it easier to solve the ordinary differential equation obtained on Maple. It can be said that the method discussed in the article allows us to solve many different tasks in mathematics, engineering, geophysics or other applied fields, to build certain software modules, which ultimately simplifies the process of computer automation of complex tasks, which we use it in algorithms and programs for automated university process management.

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