4. PRINCIPLES OF MODELING

4.1. Solving differential models based on ordinary differential equations by Euler method

Euler method can be used for finding approximate solutions (solution of the Cauchy problem) ordinary differential equations.

Let the first order differential equation in the form:

y '= f (x, y),

with initial conditions y (xo) = yo, on the interval from x0 to x hn.

Rozibyemo period considered apart from step h. Then discrete coordinate can be found on dependence:,

where i = 0, 1, 2 ... n - node number estimated net.

According Euler method, instead of receiving an analytic function y (x) can find its counterpart spreadsheet VI and in the grid. Successive value table function VI + 1 in the next node (i + 1) are determined by the known value of VI at node recurrence formula and Euler:

VI = VI + 1 + h · f (x, y) + εi,

where εi = VI + 1 - y (xi + 1) - nodular error Euler method.

As the right of f (x, y) differential equation of Euler's formula can also serve its discrete analog f (xi, yi).

The error that accumulated throughout a predetermined interval.

If | εi | and | ε | very small compared with the actual values of the VI and do not affect the calculation of the final interpretation of the results, then the approximate solution in the form of a table function is considered convergent VI to the analytical dependence y (x) in the appropriate units and. So for recurrent payments using Euler's formula as:

VI = VI + 1 + h · f (x, y).

If | εi | increases with advancing by a predetermined interval, there is so-called solution instability, which leads to nezbizhnosti table function VI to the analytical dependence y (x). Values | εi | and | ε | acquire values that are close or even to exceed the value of the function VI., which are. This decision has no value and can not be used in engineering calculations.

Considered normal Euler method a first order of accuracy relative step. This means that εi ~ h. That is, increasing half step (for example, in order to save computing resources), doubles and error εi and vice versa. Hence Solution instability by reducing the step calculation.