МИНИСТЕРСТВО ОБРАЗОВАНИЯ И НАУКИ РОССИЙСКОЙ ФЕДЕРАЦИИ

ФЕДЕРАЛЬНОЕ ГОСУДАРСТВЕННОЕ БЮДЖЕТНОЕ

ОБРАЗОВАТЕЛЬНОЕ УЧРЕЖДЕНИЕ

ВЫСШЕГО ПРОФЕССИОНАЛЬНОГО ОБРАЗОВАНИЯ

МОСКОВСКИЙ АВИАЦИОННЫЙ ИНСТИТУТ

(национальный исследовательский университет)

«МАИ»

Кафедра 806

Отчет по расчетно-графической работе

По дисциплине **«Численные методы»**

**Вариант 10**

**Задание 11**

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# Задание:

Методом прогонки с шагом h=0.1 и O решить краевую задачу для ОДУ.

# 

# Структурная схема алгоритма:

Текст программы для метода конечных разностей для краевой задачи на языке Visual Basic 6.0:

Dim Arr(), Barr(), X(), P(), Q(), a, b, h, Eps, R(), E(), Z(), Y() As Double, N As Integer

Dim Alpha, Beta, Hamma, Delta, Fi, Psi As Double, str As String

Private Sub Text1\_CLick()

Text1.Text = ""

End Sub

Private Sub Text2\_CLick()

Text2.Text = ""

End Sub

Private Sub Text3\_CLick()

Text3.Text = ""

End Sub

Private Sub Text4\_CLick()

Text4.Text = ""

End Sub

Private Sub Text5\_CLick()

Text5.Text = ""

End Sub

Private Sub Text6\_CLick()

Text6.Text = ""

End Sub

Private Sub Text7\_CLick()

Text7.Text = ""

End Sub

Private Sub Text8\_CLick()

Text8.Text = ""

End Sub

Private Sub Text9\_CLick()

Text9.Text = ""

End Sub

Private Sub Text10\_CLick()

Text10.Text = ""

End Sub

Private Sub Text11\_CLick()

Text11.Text = ""

End Sub

Private Sub Text12\_CLick()

Text12.Text = ""

End Sub

Private Sub Text13\_CLick()

Text13.Text = ""

End Sub

Private Sub Text13\_Change()

Label9.Caption = Val(Text13.Text)

End Sub

Private Sub Text14\_CLick()

Text14.Text = ""

End Sub

Private Sub Text16\_CLick()

Text16.Text = ""

End Sub

Private Sub Text17\_CLick()

Text17.Text = ""

End Sub

Private Sub Text18\_CLick()

Text18.Text = ""

End Sub

Private Sub Text18\_Change()

Label10.Caption = Val(Text18.Text)

End Sub

Private Sub Text19\_CLick()

Text19.Text = ""

End Sub

Private Sub Text21\_CLick()

Text21.Text = ""

End Sub

Private Sub Command1\_Click()

a = Val(Text13.Text)

b = Val(Text18.Text)

h = Val(Text1.Text)

Eps = Val(Text2.Text)

N = Abs(b - a) / h + 1

ReDim Arr(N, N)

ReDim Barr(N)

ReDim X(N)

ReDim Y(N)

ReDim P(N + 1)

ReDim Q(N + 1)

ReDim R(N)

ReDim E(N)

ReDim Z(N)

X(0) = a

For i = 1 To N - 1

X(i) = X(i - 1) + h

Next

If Option1.Value = True Then

For i = 0 To N - 1

R(i) = Val(Text3.Text) \* Val(Text5.Text) \* X(i) ^ Val(Text6.Text)

Next

End If

If Option8.Value = True Then

For i = 0 To N - 1

E(i) = Val(Text4.Text) \* Val(Text7.Text) \* X(i) ^ Val(Text8.Text)

Next

End If

If Option15.Value = True Then

For i = 0 To N - 1

Z(i) = Val(Text9.Text) \* Val(Text9.Text) \* X(i) ^ Val(Text11.Text)

Next

End If

If Option2.Value = True Then

For i = 0 To N - 1

R(i) = Val(Text3.Text) \* Sin(Val(Text5.Text) \* X(i) ^ Val(Text6.Text))

Next

End If

If Option9.Value = True Then

For i = 0 To N - 1

E(i) = Val(Text4.Text) \* Sin(Val(Text7.Text) \* X(i) ^ Val(Text8.Text))

Next

End If

If Option16.Value = True Then

For i = 0 To N - 1

Z(i) = Val(Text9.Text) \* Sin(Val(Text9.Text) \* X(i) ^ Val(Text11.Text))

Next

End If

If Option3.Value = True Then

For i = 0 To N - 1

R(i) = Val(Text3.Text) \* Cos(Val(Text5.Text) \* X(i) ^ Val(Text6.Text))

Next

End If

If Option10.Value = True Then

For i = 0 To N - 1

E(i) = Val(Text4.Text) \* Cos(Val(Text7.Text) \* X(i) ^ Val(Text8.Text))

Next

End If

If Option17.Value = True Then

For i = 0 To N - 1

Z(i) = Val(Text9.Text) \* Cos(Val(Text9.Text) \* X(i) ^ Val(Text11.Text))

Next

End If

If Option4.Value = True Then

For i = 0 To N - 1

R(i) = Val(Text3.Text) \* Tan(Val(Text5.Text) \* X(i) ^ Val(Text6.Text))

Next

End If

If Option11.Value = True Then

For i = 0 To N - 1

E(i) = Val(Text4.Text) \* Tan(Val(Text7.Text) \* X(i) ^ Val(Text8.Text))

Next

End If

If Option18.Value = True Then

For i = 0 To N - 1

Z(i) = Val(Text9.Text) \* Tan(Val(Text9.Text) \* X(i) ^ Val(Text11.Text))

Next

End If

If Option5.Value = True Then

For i = 0 To N - 1

R(i) = Val(Text3.Text) / Tan(Val(Text5.Text) \* X(i) ^ Val(Text6.Text))

Next

End If

If Option12.Value = True Then

For i = 0 To N - 1

E(i) = Val(Text4.Text) / Tan(Val(Text7.Text) \* X(i) ^ Val(Text8.Text))

Next

End If

If Option19.Value = True Then

For i = 0 To N - 1

Z(i) = Val(Text9.Text) / Tan(Val(Text9.Text) \* X(i) ^ Val(Text11.Text))

Next

End If

If Option6.Value = True Then

For i = 0 To N - 1

R(i) = Val(Text3.Text) \* Log(Val(Text5.Text) \* X(i) ^ Val(Text6.Text))

Next

End If

If Option13.Value = True Then

For i = 0 To N - 1

E(i) = Val(Text4.Text) \* Log(Val(Text7.Text) \* X(i) ^ Val(Text8.Text))

Next

End If

If Option20.Value = True Then

For i = 0 To N - 1

Z(i) = Val(Text9.Text) \* Log(Val(Text9.Text) \* X(i) ^ Val(Text11.Text))

Next

End If

If Option7.Value = True Then

For i = 0 To N - 1

R(i) = Val(Text3.Text) \* Exp(Val(Text5.Text) \* X(i) ^ Val(Text6.Text))

Next

End If

If Option14.Value = True Then

For i = 0 To N - 1

E(i) = Val(Text4.Text) \* Exp(Val(Text7.Text) \* X(i) ^ Val(Text8.Text))

Next

End If

If Option21.Value = True Then

For i = 0 To N - 1

Z(i) = Val(Text9.Text) \* Exp(Val(Text9.Text) \* X(i) ^ Val(Text11.Text))

Next

End If

Alpha = Val(Text12.Text)

Beta = Val(Text14.Text)

Fi = Val(Text16.Text)

Hamma = Val(Text17.Text)

Delta = Val(Text19.Text)

Psi = Val(Text21.Text)

For i = 0 To N - 1

For j = 0 To N - 1

Arr(i, j) = 0

Next

Barr(i) = 0

Next

Arr(0, 0) = 1

Arr(0, 1) = Alpha / (h \* Beta - Alpha)

Barr(0) = Fi \* h / (h \* Beta - Alpha)

Arr(N - 1, N - 2) = -Hamma / (h \* Delta + Hamma)

Arr(N - 1, N - 1) = 1

Barr(N - 1) = Psi \* h / (h \* Delta + Hamma)

For i = 1 To N - 2

Arr(i, i - 1) = 2 - h \* R(i)

Arr(i, i) = 2 \* (h ^ 2) \* E(i) - 4

Arr(i, i + 1) = 2 + h \* R(i)

Barr(i) = 2 \* (h ^ 2) \* Z(i)

Next

P(0) = 0

Q(0) = 0

P(1) = -Arr(0, 1) / Arr(0, 0)

Q(1) = Barr(0) / Arr(0, 0)

For i = 2 To N - 1

P(i) = -Arr(i - 1, i) / (Arr(i - 1, i - 1) + Arr(i - 1, i - 2) \* P(i - 1))

Q(i) = (Barr(i - 1) - Arr(i - 1, i - 2) \* Q(i - 1)) / (Arr(i - 1, i - 1) + Arr(i - 1, i - 2) \* P(i - 1))

Next

P(N) = 0

Q(N) = (Barr(N - 1) - Arr(N - 1, N - 2) \* Q(N - 1)) / (Arr(N - 1, N - 1) + Arr(N - 1, N - 2) \* P(N - 2))

For i = N - 1 To 0 Step -1

Y(i) = P(i + 1) \* Y(i + 1) + Q(i + 1)

Next

For i = 0 To N - 1

str = str & X(i) & vbTab & Round(Y(i), Eps) & vbCrLf

Next

Dim Alpha1(2), Alpha2(3), Ar(3, 3), br(3), max As Double

N = N - 1

For i = 0 To 2

For j = 0 To 2

Ar(i, j) = 0

Next

br(i) = 0

Next

Ar(0, 0) = N + 1

For i = 0 To N

Ar(0, 1) = Ar(0, 1) + X(i)

Ar(1, 1) = Ar(1, 1) + X(i) ^ 2

Ar(1, 2) = Ar(1, 2) + X(i) ^ 3

Ar(2, 2) = Ar(2, 2) + X(i) ^ 4

br(0) = br(0) + Y(i)

br(1) = br(1) + Y(i) \* X(i)

br(2) = br(2) + Y(i) \* X(i) ^ 2

Next

Ar(0, 2) = Ar(1, 1)

Ar(1, 0) = Ar(0, 1)

Ar(2, 0) = Ar(1, 1)

Ar(2, 1) = Ar(1, 2)

'Нахождение квадратичного многочлена:

For k = 0 To 2

max = Abs(Ar(k, k))

iTemp = k

For i = k + 1 To 2

If Abs(Ar(i, k)) > max Then

max = Abs(Ar(i, k))

iTemp = i

End If

Next

For j = 0 To 2

Temp = Ar(k, j)

Ar(k, j) = Ar(iTemp, j)

Ar(iTemp, j) = Temp

Next

Temp = br(k)

br(k) = br(iTemp)

br(iTemp) = Temp

If Ar(k, k) <> 0 Then

Temp = Ar(k, k)

For j = 0 To 2

Ar(k, j) = Ar(k, j) / Temp

Next

br(k) = br(k) / Temp

End If

For i = k + 1 To 2

If Ar(k, k) <> 0 Then

Temp = Ar(i, k) / Ar(k, k)

For j = k To 2

Ar(i, j) = Ar(i, j) - Ar(k, j) \* Temp

Next

br(i) = br(i) - br(k) \* Temp

End If

Next

Next

str = str & vbCrLf & "Квадратичный многочлен по МНК:" & vbCrLf

Alpha2(2) = br(2) / Ar(2, 2)

For i = 1 To 0 Step -1

Temp = 0

For j = i + 1 To 2

Temp = Temp + Ar(i, j) \* Alpha2(j)

Next

Alpha2(i) = (br(i) - Temp) / Ar(i, i)

Next

str = str & Round(Alpha2(0), Eps + 1) & "+" & Round(Alpha2(1), Eps + 1) & "\*x+" & Round(Alpha2(2), Eps + 1) & "\*x^2" & vbCrLf

Text15.Text = str

Picture1.ScaleMode = vbPixels

Picture1.BackColor = RGB(255, 255, 255)

dx = Abs((X(N) - X(0))) / Picture1.ScaleWidth

Dim min As Double

max = Y(0)

min = Y(N)

For i = X(0) To X(N) - dx Step dx

If max < Alpha2(0) + Alpha2(1) \* i + Alpha2(2) \* i ^ 2 Then

max = Alpha2(0) + Alpha2(1) \* i + Alpha2(2) \* i ^ 2

End If

If min > Alpha2(0) + Alpha2(1) \* i + Alpha2(2) \* i ^ 2 Then

min = Alpha2(0) + Alpha2(1) \* i + Alpha2(2) \* i ^ 2

End If

Next

If X(0) < X(N) Then

Picture1.Scale (X(0), max)-(X(N), min)

Else

Picture1.Scale (X(N), max)-(X(0), min)

End If

Picture1.Line (X(0), 0)-(X(N), 0)

Picture1.Line (0, max)-(0, min)

For i = X(0) To X(N) - dx Step dx

Dim func1, func2 As Double

func1 = Alpha2(0) + Alpha2(1) \* i + Alpha2(2) \* i ^ 2

func2 = Alpha2(0) + Alpha2(1) \* (i + dx) + Alpha2(2) \* (i + dx) ^ 2

Picture1.Line (i, func1)-(i + dx, func2), RGB(0, 0, 0)

Next

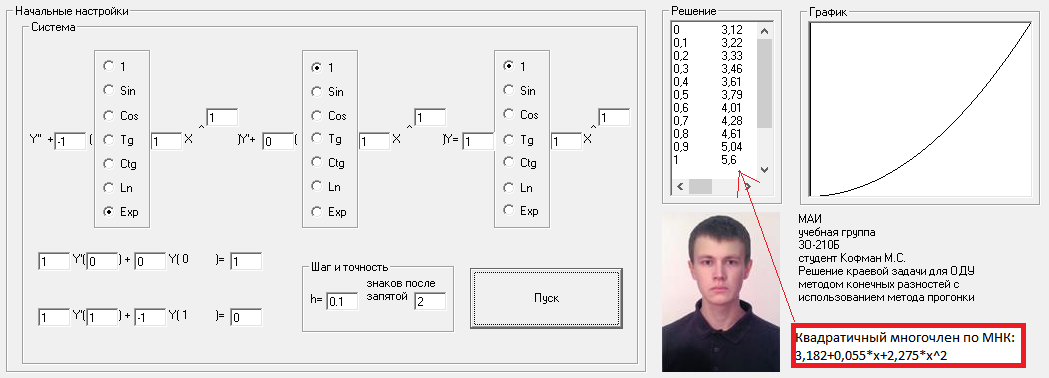
sFile = ".\Output.txt"

Open sFile For Output As #1

Print #1, Text15.Text

Close #1

End Sub

****Скриншот программы**:**

# Литература:

1. Пирумов У. Г. Численные методы, Москва, издательство МАИ 1998г.
2. 4us Самоучитель Visual Basic 6.0, http://vbzero.narod.ru (18.04.2015)