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ANNEX 3. CODI DE PROGRAMACIÓ DEL FULL DE CÀLCUL

A continuació es presenta el codi en llenguatge Visual Basic creat per al càlcul del coeficient de seguretat geomètric, de la càrrega puntual de ruptura i de la càrrega repartida de ruptura:

```
Sub seguretat()


Worksheets("principal").Range("Rh") = 1


Call troba_màxim
Call ajust


'sotida de resultats

If Hoja3.Cells(55, 50) < 0 Then GoTo fin
MsgBox ("El coeficient de seguretat geomètric de l'arc (segons Heyman) és " & Hoja3.Cells(56, 54) & "
(aproximadament)")
GoTo fin2
fin:
MsgBox ("EL COEFICIENT DE SEGURETAT GEOMÈTRIC ÉS MENOR QUE 1!!!!!")
fin2:


End Sub

_____
Sub troba_màxim()
'
'
' Macro grabada el 05/09/2004 por Saints
' Acceso directo: CTRL+m


'   1.- Definició de les variables
Dim limHsup As Variant, limHinf As Variant, rangH As Variant, pasH As Variant
Dim limeesup As Variant, limeeinf As Variant, limedsup As Variant
Dim limedinf As Variant, div As Integer

If Teoremes_límit.OptionButton1.Value = True Then
div = 20
Else
div = 10
End If

Worksheets("almacén").Range("I2") = div


Worksheets("principal").Range("ee") = 0
Worksheets("principal").Range("ed") = 0
Worksheets("principal").Range("Rh") = 1

Do While Worksheets("Arc 1").Range("min1") < 0
   Worksheets("principal").Range("Rh") = 1.1 * Worksheets("principal").Range("Rh")
Loop
limHsup = Worksheets("principal").Range("Rh")

Worksheets("principal").Range("ee") = 50
Worksheets("principal").Range("ed") = 50
```

```
If Worksheets("Arc 1").Range("min2") > 0 Then
Do While Worksheets("Arc 1").Range("min2") > 0
   Worksheets("principal").Range("Rh") = 1.05 * Worksheets("principal").Range("Rh")
Loop
Else
Worksheets("principal").Range("Rh") = 1.1 * Worksheets("principal").Range("Rh")
End If

limHinf = Worksheets("principal").Range("Rh")

rangH = limHinf - limHsup
pasH = rangH / div
Hoja4.Cells(2, 7) = rangH
Hoja4.Cells(2, 8) = pasH


'Rastreig de valors a sac
Hoja1.Cells(33, 5) = limHsup
Hoja1.Cells(30, 3) = 100
Hoja1.Cells(30, 9) = 100

Hoja4.Cells(2, 1) = Hoja3.Cells(55, 50)
Hoja4.Cells(2, 2) = Hoja1.Cells(30, 3)
Hoja4.Cells(2, 3) = Hoja1.Cells(30, 9)
Hoja4.Cells(2, 4) = Hoja1.Cells(33, 5)



Do While Hoja1.Cells(30, 3) >= 0
   Do While Hoja1.Cells(30, 9) >= 0
      Do While Hoja1.Cells(33, 5) < limHinf
      Hoja1.Cells(33, 5) = Hoja1.Cells(33, 5) + pasH

      If Worksheets("Principal").Range("rot_br1") > 0 Or Worksheets("Principal").Range("rot_br2") > 0 Then
GoTo passa
      If Hoja3.Cells(55, 50) > Hoja4.Cells(2, 1) Then
      Hoja4.Cells(2, 1) = Hoja3.Cells(55, 50)
      Hoja4.Cells(2, 2) = Hoja1.Cells(30, 3)
      Hoja4.Cells(2, 3) = Hoja1.Cells(30, 9)
      Hoja4.Cells(2, 4) = Hoja1.Cells(33, 5)
      End If
passa:

      Loop
   Hoja1.Cells(33, 5) = limHsup
   Hoja1.Cells(30, 9) = Hoja1.Cells(30, 9) - 10
   Loop
Hoja1.Cells(30, 9) = 100
Hoja1.Cells(33, 5) = limHsup
Hoja1.Cells(30, 3) = Hoja1.Cells(30, 3) - 10
Loop

Hoja1.Cells(30, 3) = Hoja4.Cells(2, 2)
Hoja1.Cells(30, 9) = Hoja4.Cells(2, 3)
Hoja1.Cells(33, 5) = Hoja4.Cells(2, 4)


End Sub
_____________________________________________________________________________
Sub ajust()

'   1.- Definició de les variables
Dim limHsup As Variant, limHinf As Variant, rangH As Variant, pasH As Variant
Dim limeesup As Variant, limeeinf As Variant, limedsup As Variant
Dim limedinf As Variant
Dim saints As Integer
```

```
saints = Worksheets("Almacén").Range("saints")

limHsup = Hoja1.Cells(33, 5) * 0.8
limHinf = Hoja1.Cells(33, 5) * 1.2
rangH = limHinf - limHsup
pasH = rangH / saints
limeesup = Hoja1.Cells(30, 3) + 8
If limeesup > 100 Then limeesup = 100
limeeinf = Hoja1.Cells(30, 3) - 8
If limeeinf < 0 Then limeeinf = 0
limedsup = Hoja1.Cells(30, 9) + 8
If limedsup > 100 Then limedsup = 100
limedinf = Hoja1.Cells(30, 9) - 8
If limedinf < 0 Then limedinf = 0

Hoja1.Cells(30, 3) = limeesup
Hoja1.Cells(30, 9) = limedsup
Hoja1.Cells(33, 5) = limHsup

Hoja4.Cells(2, 1) = Hoja3.Cells(55, 50)
Hoja4.Cells(2, 2) = Hoja1.Cells(30, 3)
Hoja4.Cells(2, 3) = Hoja1.Cells(30, 9)
Hoja4.Cells(2, 4) = Hoja1.Cells(33, 5)

Do While Hoja1.Cells(30, 3) >= limeeinf
   Do While Hoja1.Cells(30, 9) >= limedinf
      Do While Hoja1.Cells(33, 5) < limHinf
      Hoja1.Cells(33, 5) = Hoja1.Cells(33, 5) + pasH

      If Worksheets("Principal").Range("rot_br1") > 0 Or Worksheets("Principal").Range("rot_br2") > 0 Then
GoTo passa
      If Hoja3.Cells(55, 50) > Hoja4.Cells(2, 1) Then
      Hoja4.Cells(2, 1) = Hoja3.Cells(55, 50)
      Hoja4.Cells(2, 2) = Hoja1.Cells(30, 3)
      Hoja4.Cells(2, 3) = Hoja1.Cells(30, 9)
      Hoja4.Cells(2, 4) = Hoja1.Cells(33, 5)
      End If
passa:
      Loop
   Hoja1.Cells(33, 5) = limHsup
   Hoja1.Cells(30, 9) = Hoja1.Cells(30, 9) - 2
   Loop
Hoja1.Cells(30, 9) = limedsup
Hoja1.Cells(33, 5) = limHsup
Hoja1.Cells(30, 3) = Hoja1.Cells(30, 3) - 2
Loop

Hoja1.Cells(30, 3) = Hoja4.Cells(2, 2)
Hoja1.Cells(30, 9) = Hoja4.Cells(2, 3)
Hoja1.Cells(33, 5) = Hoja4.Cells(2, 4)


End Sub
```

```
Sub càrrega_puntual_ruptura()
'
'
' Macro grabada el 11/09/2004 por Saints
' Acceso directo: CTRL+r
'
Dim inici As Integer
Dim final As Integer
Dim temps As Integer

Worksheets("principal").Range("cp") = InputBox("Càrrega inicial de l'anàlisi:", "Càrrega inicial", 0)
```

```
inici = Worksheets("Almacén").Range("time")


Worksheets("principal").Range("Rh") = 1

Worksheets("principal").Range("ee") = 50
Worksheets("principal").Range("ed") = 50


'puja de 500 en 500
Do
Do While Worksheets("Arc 1").Range("AW60") > 0
   Worksheets("principal").Range("Rh") = 1.05 * Worksheets("principal").Range("Rh")
   If Worksheets("Arc 1").Range("AW56") > 0 Then
   Call troba_màxim
   Worksheets("Almacén").Range("saints") = 20
   Call ajust
   GoTo next1
   End If
Loop

next1:
If Worksheets("principal").Range("rot_arc") > 4 Then GoTo end1
Worksheets("principal").Range("cp") = Worksheets("principal").Range("cp") + 500
Loop
end1:


'puja de 100 en 100
Worksheets("principal").Range("cp") = Worksheets("principal").Range("cp") - 400

Do While Worksheets("Arc 1").Range("min1") > 0
   Worksheets("principal").Range("Rh") = Worksheets("principal").Range("Rh") / 1.05
Loop

Do
Do While Worksheets("Arc 1").Range("AW60") > 0
   Worksheets("principal").Range("Rh") = 1.05 * Worksheets("principal").Range("Rh")
   If Worksheets("Arc 1").Range("AW56") > 0 Then
      If Worksheets("Principal").Range("cp") > 500 Then Worksheets("Almacén").Range("saints") = 50 Else
Worksheets("Almacén").Range("saints") = 20
         If Worksheets("Principal").Range("cp") <= 100 Then
         Worksheets("Principal").Range("cp") = 100
         Call troba_màxim
         End If
   Call ajust
   GoTo next2
   End If
Loop

next2:
If Worksheets("principal").Range("rot_arc") > 4 Then GoTo end2
Worksheets("principal").Range("cp") = Worksheets("principal").Range("cp") + 100
Loop
end2:

'puja de 10 en 10

Worksheets("principal").Range("cp") = Worksheets("principal").Range("cp") - 90

Do While Worksheets("Arc 1").Range("min1") > 0
   Worksheets("principal").Range("Rh") = Worksheets("principal").Range("Rh") / 1.05
Loop

Do
Do While Worksheets("Arc 1").Range("AW60") > 0
   Worksheets("principal").Range("Rh") = 1.05 * Worksheets("principal").Range("Rh")
```

```
    If Worksheets("Arc 1").Range("AW56") > 0 Then
    Worksheets("Almacén").Range("saints") = 50
        If Worksheets("Principal").Range("cp") <= 10 Then
        Worksheets("Principal").Range("cp") = 10
        Call troba_màxim
        End If
    Call ajust
    GoTo next3
    End If
Loop

next3:
If Worksheets("principal").Range("rot_arc") > 4 Then GoTo end3
Worksheets("principal").Range("cp") = Worksheets("principal").Range("cp") + 10
Loop
end3:

final = Worksheets("Almacén").Range("time")

temps = final - inici
If temps < 0 Then
temps = 3600 - inici + final
End If


MsgBox ("temps de càlcul: " & temps & " segons")


MsgBox "La càrrega puntual de ruptura de l'estructura és " & Worksheets("principal").Range("cp") & " kN"


End Sub
_____________________________________________________________________________
Sub carrega_rep_ruptura()
'
'utilitzo la mateixa rutina que en el cas del coeficient de seguretat però amb menys precisió i augmentant
la càrrega
'
Dim inici As Integer
Dim final As Integer
Dim temps As Integer

Worksheets("principal").Range("cr") = InputBox("Càrrega inicial de l'anàlisi:", "Càrrega inicial", 0)

inici = Worksheets("Almacén").Range("time")


Worksheets("principal").Range("Rh") = 1

Worksheets("principal").Range("ee") = 50
Worksheets("principal").Range("ed") = 50


'puja de 500 en 500
Do
Do While Worksheets("Arc 1").Range("AW60") > 0
    Worksheets("principal").Range("Rh") = 1.05 * Worksheets("principal").Range("Rh")
    If Worksheets("Arc 1").Range("AW56") > 0 Then
    Call troba_màxim
    Worksheets("Almacén").Range("saints") = 20
    Call ajust
    GoTo next1
    End If
Loop

next1:
If Worksheets("principal").Range("rot_arc") > 4 Then GoTo end1
```

```
Worksheets("principal").Range("cr") = Worksheets("principal").Range("cr") + 500
Loop
end1:


'puja de 100 en 100
Worksheets("principal").Range("cr") = Worksheets("principal").Range("cr") - 400

Do While Worksheets("Arc 1").Range("min1") > 0
   Worksheets("principal").Range("Rh") = Worksheets("principal").Range("Rh") / 1.05
Loop

Do
Do While Worksheets("Arc 1").Range("AW60") > 0
   Worksheets("principal").Range("Rh") = 1.05 * Worksheets("principal").Range("Rh")
   If Worksheets("Arc 1").Range("AW56") > 0 Then
      If Worksheets("Principal").Range("cr") > 500 Then Worksheets("Almacén").Range("saints") = 50 Else
Worksheets("Almacén").Range("saints") = 20
         If Worksheets("Principal").Range("cr") <= 100 Then
         Worksheets("Principal").Range("cr") = 100
         Call troba_màxim
         End If
   Call ajust
   GoTo next2
   End If
Loop

next2:
If Worksheets("principal").Range("rot_arc") > 4 Then GoTo end2
Worksheets("principal").Range("cr") = Worksheets("principal").Range("cr") + 100
Loop
end2:

'puja de 10 en 10

Worksheets("principal").Range("cr") = Worksheets("principal").Range("cr") - 90

Do While Worksheets("Arc 1").Range("min1") > 0
   Worksheets("principal").Range("Rh") = Worksheets("principal").Range("Rh") / 1.05
Loop

Do
Do While Worksheets("Arc 1").Range("AW60") > 0
   Worksheets("principal").Range("Rh") = 1.05 * Worksheets("principal").Range("Rh")
   If Worksheets("Arc 1").Range("AW56") > 0 Then
   Worksheets("Almacén").Range("saints") = 50
         If Worksheets("Principal").Range("cr") <= 10 Then
         Worksheets("Principal").Range("cr") = 10
         Call troba_màxim
         End If
   Call ajust
   GoTo next3
   End If
Loop

next3:
If Worksheets("principal").Range("rot_arc") > 4 Then GoTo end3
Worksheets("principal").Range("cr") = Worksheets("principal").Range("cr") + 10
Loop
end3:

final = Worksheets("Almacén").Range("time")

temps = final - inici
If temps < 0 Then
temps = 3600 - inici + final
End If
```

```
MsgBox ("temps de càlcul " & temps & " segons")

'Sortida de resultats

MsgBox "La càrrega repartida de ruptura entre les dovelles " & Worksheets("Principal").Range("d_ini") & "
i " & Worksheets("Principal").Range("d_fin") & " és " & Worksheets("Principal").Range("cr") & " kN/metre"
'
End Sub
```