

TechNote Excel VBA Example

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Example of Using OpenDSS COM Interface Via Excel VBA

This example could serve as a starting point for using OpenDSS in academic projects. This illustrates driving the OpenDSS from VBA to find the lowest loss solution using the Branch Exchange method (per Civanlar). Some of the details have been omitted for brevity, but you should get the general idea.

The exchange algorithm is “greedy” and will always try to make a switch exchange. The main stopping criterion is when the losses increase after an exchange, meaning the algorithm has found and passed through a local minimum. The exchange method should never create a loop nor isolate a load. If either occurs, the loop halts under what might be considered an error condition.

This is an excerpt from an upcoming EPRI report: "Example Assessments of Distribution Automation Using OpenDSS"

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'
' Author: Tom McDermott
'

Private Sub Preamble()
    gPath = Range("DataPath")           ' Read the model file and path names from Excel sheet
    gBase = Range("BaseFile")

    Set eng = CreateObject("OpenDSSEngine.DSS") ' Starts OpenDSS
    eng.start (0)
    Set txt = eng.Text                     ' Load base file name using the Text interface of OpenDSS
    txt.Command = "clear"
    txt.Command = "compile " & gPath & gBase

    Set ckt = eng.ActiveCircuit           ' Circuit interface
    Set swt = ckt.SwtControls             ' new SwtControl interface on the active circuit
    Set cap = ckt.CapControls             ' CapControl interface
    Set reg = ckt.RegControls             ' RegControl interface
    Set mon = ckt.Monitors                ' Monitors interface
    Set mtr = ckt.Meters                  ' (Energy)Meters interface
    Set topo = ckt.Topology               ' new Topology interface
End Sub

Public Sub BranchExchange()
    Dim iter, c, r, i, k As Integer
    Dim done As Boolean
    Dim Vdiff, Vmax As Double
    Dim LastLoss, ThisLoss As Double
    Dim ToClose, ToOpen, LowBus As String

    Preamble ' Starts OpenDSS, loads in circuit description and defines some vard
    Set ws = ActiveWorkbook.Worksheets("Switching")

    iter = 1    this is the number of branch exchange trials, limited to 10
    done = False
    LastLoss = 1E+99
```

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While Not done
    r = iter + 1
    ws.Cells(r, 10) = iter
    ckt.Solution.Solve          solve the current system
    ThisLoss = ckt.Losses(0)
    ws.Cells(r, 11) = ThisLoss    write current losses, # loops, # isolated loads to sheet
    ws.Cells(r, 12) = CStr(ckt.Topology.NumLoops) & " _ " & _
                                CStr(ckt.Topology.NumIsolatedLoads)

    Vmax = 0#                    track the maximum voltage difference across any open switch
    ToClose = ""
    ToOpen = ""
    LowBus = ""
    c = 14    column number for output
    i = swt.First    check all SwtControls
    While i > 0 ' find the open switch with biggest delta-V
        If swt.Action = dssActionOpen Then    check only open switches
            ws.Cells(r, c) = swt.name
            Set elem = ckt.CktElements(swt.SwitchedObj)
            Vdiff = Abs(elem.SeqVoltages(1) - elem.SeqVoltages(4))    V1 across switch
            If Vdiff > Vmax Then    if highest V1 difference so far...
                LowBus = FindLowBus which side of open switch has lowest V?
                topo.BusName = LowBus    start from that bus in the topology
                Set elem = ckt.ActiveCktElement
                k = 1
                While (Not elem.HasSwitchControl) And (k > 0) trace back from low bus to src
                    k = topo.BackwardBranch    until we find a closed switch
                Wend
                If elem.HasSwitchControl Then    if we found a switch to close...
                    Vmax = Vdiff    keep this as the highest voltage difference found
                    ToClose = swt.name    we will close this currently-open switch
                    ToOpen = Mid(elem.Controller, 12)    and open the switch from back-trace
                End If
            End If
            c = c + 1
        End If
        i = swt.Next
    Wend
    ws.Cells(r, 13) = CStr(Vmax)

    done = True ' unless we found a switch pair to exchange
    If Len(ToOpen) > 0 And Len(ToClose) > 0 Then    found a switch pair to exchange
        swt.name = ToClose    do the switch close-open via SwtControl interface
        swt.Action = dssActionClose
        swt.name = ToOpen
        swt.Action = dssActionOpen
        done = False ' try again    i.e., run solution again and look for the next exchange
    End If

    iter = r
    ' stop if too many iterations, system is non-radial, or losses go up
    If iter > 10 Or ckt.Topology.NumIsolatedLoads > 0 Or ThisLoss > LastLoss Then
        done = True met one of the three stopping criteria
    End If
    LastLoss = ThisLoss    best loss total found so far
Wend
End Sub

' This function is called from the loop above
' "elem" is a CktElement already set to the open branch, from the loop calling FindLowBus

Private Function FindLowBus() As String
    Dim i As Integer
    Dim v As Double

```

```
FindLowBus = ""  
v = 9.9E+100  
For i = 0 To elem.NumTerminals - 1  loop over all element terminals  
    If elem.BusNames(i) <> "0" Then  
        Set b = ckt.Buses(elem.BusNames(i)) look up the Bus connected to terminal  
        If b.SeqVoltages(1) < v Then          track the lowest bus positive sequence voltage  
            v = b.SeqVoltages(1)  
            FindLowBus = elem.BusNames(i)    return name of bus with lowest V1  
        End If  
    End If  
Next i  
End Function
```

--Rdugan 14:44, 22 April 2011 (UTC)

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