Tutorial for Cadence Innovus Place & Route

For Innovus Version 16.2

T. Manikas, Southern Methodist University, 2/26/2019

Contents
1 Preliminary Setup .......................................................................................................................... 1
2 Starting Tool and Reading in the Design Files .......................................................................... 2
  2.1 Saving and Restoring Your Design ....................................................................................... 10
3 Floorplanning ............................................................................................................................. 12
  3.1 Specify Floorplan ................................................................................................................... 12
4 Power Planning .......................................................................................................................... 14
  4.1 Connect Global Nets .............................................................................................................. 14
  4.2 Power Rings .......................................................................................................................... 15
  4.3 Power Stripes ....................................................................................................................... 18
  4.4 Connect Power to Standard Cell Rows .................................................................................. 22
5 Placing the Standard Cells ....................................................................................................... 23
6 Routing ...................................................................................................................................... 24
7 Adding Filler Cells ...................................................................................................................... 26

1 Preliminary Setup
Create a separate directory for the above files in your account (e.g., Innovus). Create the subdirectories synth and lib

1. Move full_adder_pads_syn.v to the synth directory
2. Move osu05_stdcells.lef to the lib directory
2 Starting Tool and Reading in the Design Files

1. Make sure that you are in your main separate directory (e.g., Innovus) as mentioned earlier
2. At the Unix prompt, type: `innovus`
3. When the Innovus tool window appears, go to the menu bar and select **File, Import Design** to get the Design Import window.

4. For the **Verilog Netlist**, click on the box with the dots [...] to open the **Netlist Files window**
5. Click on the ">>" button to expand the window to show the directories:
6. Double-click on the synth folder, then select the file `full_adder_pads_syn.v` and click the Add button to add it to the Netlist Files list. Click Close to close the Netlist Files window.
7. In the main window, for Top Cell, select "Auto Assign"
8. For Technology/Physical Libraries, select "LEF Files". Click on the [...] button open the LEF Files window.
9. Using the same approach as for selecting the Verilog Netlist file, select the file `lib/osu05_stdcells.lef`
10. For **Power**, enter the following:
   a. **Power Nets**: `vdd`
   b. **Ground Nets**: `gnd`

11. Click on **OK**.
2.1 Saving and Restoring Your Design

NOTE: It is a good idea to save your design periodically. Select File, Save Design. In the Save Design Window, select Data Type: Innovus.

To load a saved Innovus file, do File, Restore Design. In the Restore Design Window, select Data Type: Innovus. Select the file to be restored.
3 Floorplanning

3.1 Specify Floorplan

In Innovus tool menu bar, select Floorplan, Specify Floorplan to get the Specify Floorplan window.

1. In the Basic tab, select the following options:
   a. Core Margins – select Core to IO Boundary and set all margins to 100
2. Click on OK.
4 Power Planning
4.1 Connect Global Nets

In Innovus tool menu bar, select Power, Connect Global Nets to get the Global Net Connections Window.

1. In Power Ground Connection
   a. In the Connect area, select Pin
   b. In the Scope area, select Apply All

2. For each net vdd and gnd, do the following:
   a. Enter the net name (vdd or gnd) in the following boxes:
      i. "To Global Net"
      ii. "Pin Name(s)"
   b. Click on the "Add to List" button

3. Click Apply, then click Cancel
4.2 Power Rings

In Innovus tool menu bar, select **Power, Power Planning, Add Ring** to get the **Add Rings** window.

1. For Net(s), enter **vdd** and **gnd** nets as follows:
   a. Click on folder icon to the right of the **Net(s)** box to get Net Selection window
   b. Select **vdd** and **gnd** from Possible Nets column
   c. Click **Add** to copy to Chosen Nets column
   d. Click **OK**
2. In **Ring Configuration**, select **metal1** for Top and Bottom, **metal2** for Left and Right.
   a. Width should be 8
   b. Spacing should be 1
   c. Offset should be “Center in channel”

3. Click OK
4.3 Power Stripes

In Innovus tool menu bar, select **Power, Power Planning, Add Stripes** to get the **Add Stripes** window.

1. **Basic Tab**
   a. For Net(s), enter **vdd** and **gnd** nets as follows:
      i. Click on folder icon to the right of the **Net(s)** box to get Net Selection window
      ii. Select **vdd** and **gnd** from Possible Nets column
      iii. Click Add to copy to Chosen Nets column
      iv. Click OK
b. In **Set Configuration**, select Layer metal2 and Direction vertical. Width should be 8 and Spacing should be 1.

c. In **Set Pattern**, set Set-to-set distance to **100**

d. In **First/Last Stripe**, select Relative from core or selected area, set start to **20**
2. **Advanced Tab**
   a. Set Snap wire center to routing grid as Grid

3. Click OK
4.4 Connect Power to Standard Cell Rows

In Innovus tool menu bar, select Route, Special Route, and click OK. This will create power (vdd) and ground (gnd) rails for your standard cell rows. Save your design using the procedure described in Section 0 above.
5 Placing the Standard Cells

In Innovus tool menu bar, select **Place, Place Standard Cell** to get the Place window.

1. Select “Run Full Placement” and “Include Pre-Place Optimization”
2. Click OK

After cells are placed, change to **Physical View** in the Innovus Window to see placement results.
6 Routing
In Innovus tool menu bar, select Route, NanoRoute, Route to get the NanoRoute window.

1. Click OK.
7 Adding Filler Cells

1. Now that we have routed all the wires and placed all the cell in our design, we will add empty filler cells to the design. Select Place, Physical Cell, Add Filler.

2. In the Add Filler window, enter the Cell Name FILL and check Mark Fixed. Click OK.

3. Note that filler cells are added to the layout: