**Routing in Physical Design**

ECE 510

Spring 2019

1. **Objective: To know basics of routing along with a set of advanced design options in routing.**
2. If needed RTL or netlist will be provided; you may start with any of the designs used in HW\_LAB of this course.
3. The design should have area utilization of 80% or more excluding HIPs or macros. The design at post route stage should have at least 10 –ve max paths with WNS of -100 ps. There should not be any short or open in the final design.
4. No proc should have more than 10 lines excluding any comments; if needed add more procs and call them from the main proc.
5. Go over the associated XLS file (General Reporting for CTS UPF Routing.xlsx) named to know what to be including for general reporting.
6. Reference material: Routing from ICC UG Chapter 6

Set variables to get the maximum information or messages from all routing stages; for example, set the following:

set\_route\_zrt\_common\_options -verbose\_level 1

1. Routing Critical Nets using route\_zrt\_group: Write a proc named as below which will use make the tool (ICC) to use specified routing layers for the top N (user given) paths or for a path with given start/end points; the proc will give option to use which metal layers to use; proc will also allow option to use certain metal layers based on the length of the nets in those paths; other options are given below as part of the help message which the proc will show and perform:

proc\_special\_route\_nets\_in\_critical\_paths -help

Usage: proc\_special\_route\_nets\_in\_critical\_paths

[-top\_N\_paths] number of top max paths

[-slack\_worse\_than] for paths worse than this slack

[-from] pins, ports, nets or clocks

[-to] pins, ports, nets or clocks

[-metal\_layers] comma separated metal layers to be used for the nets in the paths

[-min\_length] when this option is given, only use the above metal layers if lengths of the nets in the paths is bigger than min\_length

[-min\_layer] when this option is given, use metal layers above this layer

[-widen\_wire] how much wider the metal layers would be compared to default width

[-use\_shield] yes or no

The proc will output details of the all the above such as why it did not apply specified metal layers as min length condition was not met. It will collect the path details before making the special routes and also, show if any of the layers got changed due to application of this proc, it will show if there is timing improvement in the critical path due to the usage of this proc. Also, the proc will capture all the design rule violations (e.g. max cap), before and after this proc. It will also report out if there is any increase of short count.

You may have to consider wider via too.

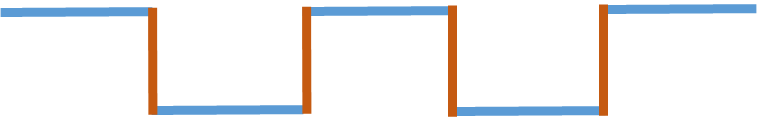
Commands to consider:

set\_net\_routing\_layer\_constraints

define\_routing\_rule

set\_net\_routing\_rule

1. Compare usage of route\_zrt\_group command with the proc written by you from above proc\_special\_route\_nets\_in\_critical\_paths. For the use of route\_zrt\_group, you would be using post route based timing of the current design and redo the signal routing with the application of route\_zrt\_group first for the top paths or start/end points and route the rest of the nets.
2. Routing Corridor: Using any design with a HIP or macro, show how you routing to go around the HIP as shown in “Figure 6-3 Using a Routing Corridor” in ICC UG.
3. Route guide: Write a proc that will generate a routing shape as follows; consider a buffer in the left side and another at the right side to begin with. The length of the horizontal and vertical segments are given by user along with the layer themselves; depending the max cap and max transition requirements, more buffers may have to be added after the routing shape is generated.



Usage: proc\_route\_guide\_zigzag

[-hor\_layer] ex: M5

[-vert\_layer] ex: M4

[-hor\_seg\_length] ex: 100

[-vert\_seg\_lenght] ex: 50

[-min\_layer] when this option is given, use metal layers above this layer

[-widen\_wire] how much wider the metal layers would be compared to default width

[-use\_shield] yes or no

The proc would output:

1. Total vertical length and horizontal length before the routing takes place with this proc
2. The RC or net delay with default routing – meaning no zigzag and as is from the tool.
3. The RC or net delay after the making zigzag route with this proc
4. DRC before this proc
5. DRC after this proc
6. Number of vertical and horizontal segments added
7. Metal layers of the vertical and horizontal segments added
8. Number of buffers needed to be added to fix DRC violations.