EEDG 6375

DESIGN AUTOMATION OF VLSI SYSTEMS

Fiduccia Mattheyses Heuristic

PROJECT REPORT

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EXECUTION PROCEDURE:

(DETAILS ABOUT RANDOM CUTSET GENERATION):

We executed the fiduccia Mattheyses algorithm, to reduce the cutset for partitioning the given netlists.

We implemented the algorithm to run 8 passes.

For each run we implemented a new random cutset:

1. Random Cutset 1 file (v1.0) : We read the nodefile sequentially and assign each node to an alternate partition.

2. Random Cutset 2 file (v1.1) : We read the nets sequentially and assign each node in one net to a partition and the alternate net's nodes to the other partition. If a node is repeated, the latest assignment is considered.

3. Random cutset 3: file (v1.2) We assign the first n nodes in the nodes file to one partition such that (wgt of part 1)/(total weight) is less than 0.5. After this we have the other nodes assigned to the other partition.

4. Random cutset 4: file (v1.3) We assigned the first quarter of the nodes (by weight) to part A and second quarter in part B, third quarter in part A and rest in part B.

5. Random cutset file (v1.4) 5: we assigned first 10 in part A, next 10 in part B and so on until all nodes are assigned a partition.

RATIO CUT: In every output file (generate by following instructions in Readme) we get a value for ratio cut.

If the value of ratio cut is x. It means the entire circuit has been partitioned in (x:1) ratio.

↳ example: If the ratio cut is 1.2:1 it means

$\frac{1.2}{1+1.2} \times 100 \Rightarrow \frac{1.2}{2.2} \times 100 \Rightarrow \sim 54.5\%$ of the circuit is in one partition & 45.5% is in another partition. ↓ % by weight.

BALANCE CONDITION: We used a balance condition of 40%.:60%.

$\Rightarrow r_{max} = 0.6 \quad r_{min} = 0.4.$

$$0.4 \leq \frac{\text{weight}_{(part)}}{\text{weight}_{(Total)}} \leq 0.6$$

OBSERVATION: We observe that, using random cutset 3, ie Slicing the nodes file in half, we get the BEST INITIAL RANDOM CUTSET. (FPGA, 2, 3 & 4). The best cutset for FPGA-1 was 369. It was attained with random cutset 4 after 31 passes. (Details in excel)

Marked with → in excel sheet.

least cutset for each benchmark is placed in a red square. & written in red.

Partitioning Results Reporting Sheet

Benchmark Name	Run #	Execution Time	Starting Cut	Ending Cut	ercentage Change
Example 1:	1	5	2365	676	71.41649049
FPGA-Example 1:	2	4.57	2000	629	68.55
(Time in Seconds)	3	7.02	2541	509	79.96851633
	4	5.64	2220	483	78.24324324
	5	8.38	1897	566	70.16341592
	Average	6.104			73.6683332
Example 2:	1	247	438715	89886	79.51152799
(Time in Minutes)	2	235	329166	88162	73.21655335
	3	288	9077	3417	62.35540377
	4	227	14674	7674	47.70342102
	5	303	276096	89260	67.67066528
	Average	260			66.09151428
Example 3:	1	179	355654	85554	75.94459784
(Time in Minutes)	2	194	292082	80062	72.5892044
	3	201	15558	12912	17.00732742
	4	183	40043	33015	17.55113253
	5	212	266574	84854	68.16868862
	Average	193.8			50.25219016
Example 4:	1	608	728801	131583	81.94527724
(Time in Minutes)	2	631	604579	122807	79.68718728
	3	601	13222	10586	19.93646952
	4	589	23599	20103	14.81418704
	5	612	503407	132190	73.74092931
	Average	608.2			54.02481008

*Minimum cutset attained is marked in red

*Execution time is CPU Time and is in Seconds. Actual Time of Execution for **8 Passes** per Run is shown Below:

Benchmark	Time
FPGA-Example1	6.1 Seconds
FPGA-Example2	260 Minutes
FPGA-Example3	193.8 Minutes
FPGA-Example4	608.2 Minutes

Value of final cutset in the 4th random cutset, stagnates after 5 runs. for FPGA3,4.

Additional Simulations	(30 Passes per Run)				
Benchmark Name	**Run #**	**Execution Time**	**Starting Cut**	**Ending Cut**	**ercentage Change**
Example 1:	1	22	2365	676	71.41649049
FPGA-Example 1:	2	19.91	2000	629	68.55
Time in Seconds	3	21.54	2541	485	80.91302637
	4	21.49	2220	369	83.37837838
	5	17.25	1897	563	70.32156036
	Average	20.372			74.91589112

The absolute minimum ending cut for fpga1 is achieved after using random cut #4 and running the heuristic for 30 passes.

Random cuts #1, #2 & #5 stagnate after 8-10 passes of FM.

X — THE — X — END — X