

Logic-Level Synthesis Contest 20/21

Synthesis and Optimization of Digital Systems

Description

Write a command for PrimeTime that implements a post-synthesis power minimization procedure. The new command, written in TCL, runs a timing-constrained dual-Vth cell assignment with gate re-sizing. The only input argument is the negative slack that is allowed after the optimization process:

$$\text{slack} \geq \text{allowed_slack}, \text{ allowed_slack} \leq 0$$

SYNOPSIS

```
dualVth -allowed_slack $allowed_slack_value$
```

EXAMPLE

```
dualVth -allowed_slack -0.5 ;# A slack of -0.5 ns is allowed to reduce the  
power consumption
```

Evaluation

The best algorithm is the one that matches the timing constraint while reaching the smallest dynamic power consumption, leakage power consumption, and area, using the lowest amount of CPU time. The evaluation metrics are as follows:

1. compliance to the input constraint *allowed_slack_value*;
2. area (lower is better);
3. dynamic power (lower is better): sum of internal and switching power;
4. leakage power (lower is better);
5. CPU time (lower is better): the amount of time for which the CPU is used for processing the script. It will be measured using the TCL **clock** command. Note that a maximum of 15 minutes is allocated for each run during evaluation. Thus, the CPU time must always be lower than 15 minutes.

Specifically, the following score function (higher is better) will be used to evaluate the script:

$$\text{Score} = \left(\frac{\text{area_initial}}{\text{area_final}} + \frac{\text{Pleakage_initial}}{\text{Pleakage_final}} + \frac{\text{Pdynamic_initial}}{\text{Pdynamic_final}} \right) * \left(1 - \frac{\text{cpu_time}}{900} \right)$$

Basic Rules for the Competition

1. Combinational circuits will be used as benchmarks, e.g., `c1908.v` and `c5315.v`.
Note: the algorithm must be general and will be tested on other benchmarks, too.
2. The command will be executed under PrimeTime, just after the script `pt_analysis.tcl`
3. The initial gate-level netlist contains only cells from the `CORE65_LP_LVT` library. It is possible to assume that all paths of the netlist have slack ≥ 0 .
4. All the groups are invited (mandatory) to use the template available on the webpage of the course. Other additional procedures can be used only if invoked within the `dualVth` procedure.
5. Scores:
 - groups that deliver a working script (constraints met) will get **3** points;
 - the best algorithm will get **3** extra points;
 - fake (and/or cut&paste) scripts will get **-3** points.

Each group will send an e-mail to andrea.calimera@polito.it and antonio.cipolletta@polito.it (in cc) using as subject <SODS21 LL Group_N> (N the ID of the group). Attached with the mail the following two (2) files:

1. one (1) single TCL file, titled <dualVth_group_N.tcl>, containing the code of the procedure
2. one (1) page pdf, titled <dualVth_group_N.pdf>, which gives a brief description of the algorithm

***** DEADLINE July 11 (hh 23:59 CET) 2021*****

(late messages, or messages not compliant with the above specs, will be automatically discarded)