18-743
Project Proposal

RIPE: A Rapid Implication-based Power Estimator

Sunil Motaparti, Gaurav Bhatia

OUTLINE

- Problem to Solve
- Motivation
- Approach
- Milestones
PROBLEM TO SOLVE

- Gate Level Power Estimation
- Computing Average switching activity of a circuit gives a somewhat accurate estimation of power consumption
- Consideration of spatio-temporal correlations yield more accurate estimations of the average switching activity
  - Done using Markov chains which compute step-transition probabilities (as discussed in lecture)

MOTIVATION

- Some of the Early work has not dealt with reconvergent fanout
- More recent work that deals with the above has involved using OBDD’s which are computation intensive and slow
- Most of the approaches have not been line independent and hence an algorithm which can reduce this dependency is desirable
**APPROACH**

- Static Learning (also called Static Logic Implication) can be used
  - Find implications of setting a line $l$ to a particular value $v$
    - Direct Implications
      - Forward / Backward Simulation
    - Indirect Implications
      - Contrapositive Law
      - Extended Backward Implication
    - Iterative
    - Implemented using set operations
  - Implicitly captures the reconvergent fanout structures in the circuit

**APPROACH (contd.)**

- Computing Step Transition Probabilities
  - Find Crucial Nodes
    - Sets of Nodes through which paths from primary inputs to lines have to pass through
    - Dominators
    - Min-Cut
    - Limit size to 5-6
  - For a set of $n$ crucial nodes, we have $2^n$ combinations of values for current clock cycle and $2^n$ combinations of values for next clock cycle
    - We have $2^{2n}$ pairs of distinct combinations of values
    - For each pair, we update the transition counts on each line that is present in the implication sets of the current and next combinations by doing set union and set intersection operations
    - we compute step transition probability using the formula:
      $$\text{stp}(x) = \frac{\# \text{ of times } x \text{ switched for } 2^n \text{ pairs}}{2^n}$$
  - Mostly Line Independent
    - For nodes that were not covered by any set of crucial nodes, we compute the step transition probabilities one by one
MILESTONES

- 1st Report
  - Build event-driven simulator and various parts of the implication engine
- 2nd Report
  - Finish building implication engine
- 3rd Report
  - Implement Crucial-node computation and finish complete implementation
- Final Report
  - Optimizations (if above milestones are met)

Questions ?