Reset Your Reset Domain Crossing (RDC) Verification with Machine Learning

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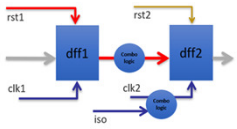
INTRODUCTION (or REQUIREMENTS)

The RDC Setup and Noise Challenge

CDC verification/setup needs to come first

RDC constraints can be challenging

- Reset ordering, clock & data isolation



RDC challenges include:

- Quickly setting up a baseline of RDC analysis with minimal noise
- Refining the setup to get more accurate results
- Understanding related violations to create minimal, accurate constraints

These challenges are well suited to automated assistance from machine Learning (ML)

OBJECTIVES

Can Machine Learning for RDC perform as well as a user in generating a set of suggested constraints?

Study looked at performance, noise and RDC results to determine effectiveness and accuracy of ML versus hand generated constraints

Reference design :

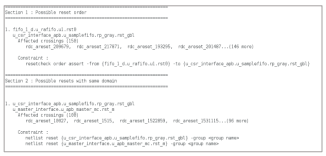
- 10 million state bits, 3 clock groups, 8 reset groups
- 90K RDC paths, utilizing various RDC mitigation strategies

Design chosen had already undergone RDC verification, so valiid user-constraints already existed

RESULTS

Questa RDC ML flow generates suggestions for RDC constraints

- Various constraint types
- Example RDC paths
- Total affected RDC paths
- Constraint syntax



Baseline design created by removing all RDC constraints and running analysis in Questa RDC

- 10000+ RDC Violations

ML constraint suggestions for baseline design:

- 9 reset ordering constraints
- 1 reset grouping constraint
- 14 clock isolation constraints

RESULTS

RDC ML Results

Applying ML reset ordering constraints to design:

- 440 RDC violations compared to 10000 from baseline

Applying clock isolation constraints:

- 4436 crossings affected compared to 4446 with hand-generated constraints

Applying a mix of user reset ordering constraints and ML clock isolation constraints:

- 221 RDC violations compared to 10000 from baseline

CONCLUSIONS

RDC ML Assist generated constraints correlate very well to user generated constraints

- Highly similar constraints affecting similar number of RDC paths

Combined User constraints + ML constraints yield very good results

- RDC paths from 1000's to hundreds with minimal effort

RDC ML performance

- No noticeable runtime or memory impact

REFERENCES

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