積體電路測試 期末專題
N-detect TDF ATPG and Compression

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Problem Description

N-detect transition delay fault ATPG (in LOS mode):

-improve test quality

-test patterns are long and costly

Test Compression is needed

-static and dynamic test compression

TDF ATPG

First apply SSF model for V2 , then check V1

LOS mode => cannot control V1 directly!

First shift back an X,

then find if there's possible PI assignment for V1.

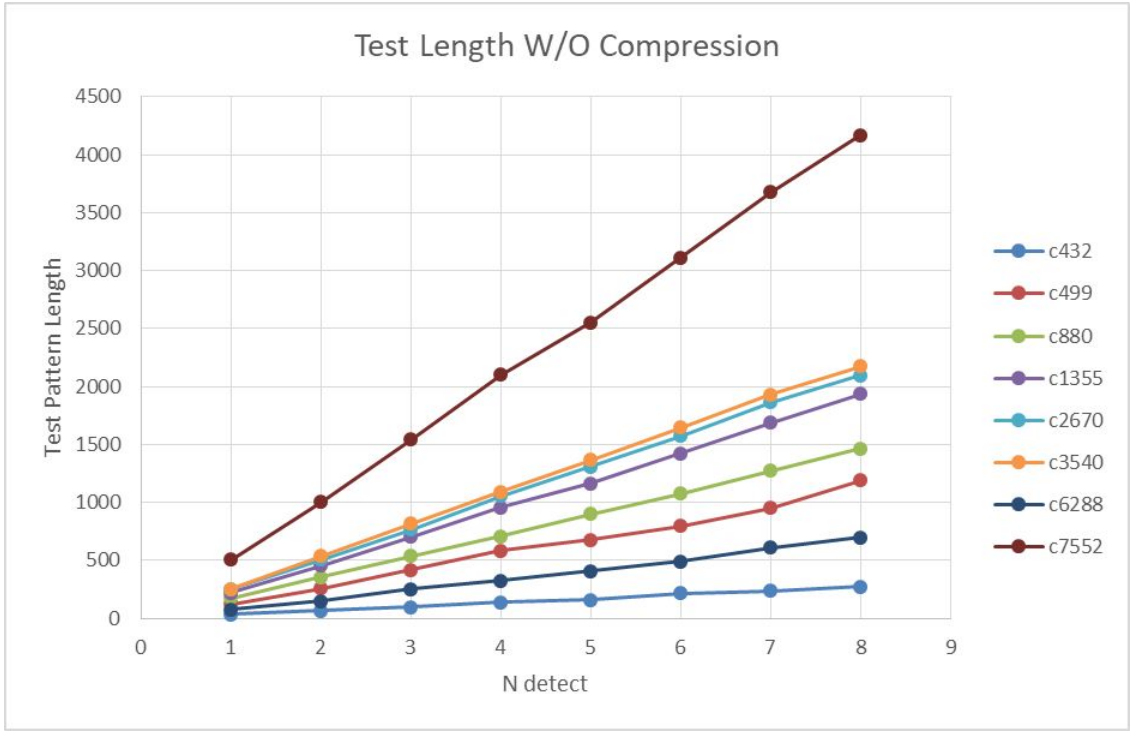
If not, backtrack!

N-detect

Duplicates the test pattern by n detect input

- Records PI with x after podem (and possible DTC)
- Random fills X input with random numbers
- Records all duplicated output for fault dropping
- Display IO (if no STC)

N-detect Result



N-detect Result

Ndet 1	Test length w/o compression	fault coverage	run time	Test length w/ compression	fault coverage	run time	Test length reduction
c432	36	11.62%	0	32	11.62%	0.1	11.11111111
c499	124	89.25%	0.3	74	89.54%	0.5	40.32258065
c880	173	50%	0.2	63	48.95%	0.4	63.58381503
c1355	223	37.19%	1.3	57	37.23%	1.3	74.43946188
c2670	250	91.89%	0.6	200	91.75%	0.8	20
c3540	254	22.59%	6.7	57	22.38%	11.4	77.55905512
c6288	78	97.31%	2.1	91	97.38%	5	-16.66666667
c7552	508	97.67%	3	383	97.72%	4.1	24.60629921

Ndet 8	Test length w/o compression	fault coverage	run time	Test length w/ compression	fault coverage	run time	Test length reduction
c432	272	11.62%	0.1	171	11.62%	0.1	37.13235294
c499	1192	87.70%	0.4	623	89.29%	0.8	47.73489933
c880	1464	49.71%	0.4	494	49.05%	0.8	66.2568306
c1355	1936	36.79%	1.6	452	36.94%	1.9	76.65289256
c2670	2096	91.78%	1.3	1353	91.78%	2.8	35.44847328
c3540	2176	22.43%	7.8	621	22.26%	14.9	71.46139706
c6288	696	97.47%	3.5	643	97.39%	8.7	7.614942529
c7552	4168	97.72%	7.2	2539	97.71%	16.1	39.08349328

Test Compression

Dynamic Test Compression:

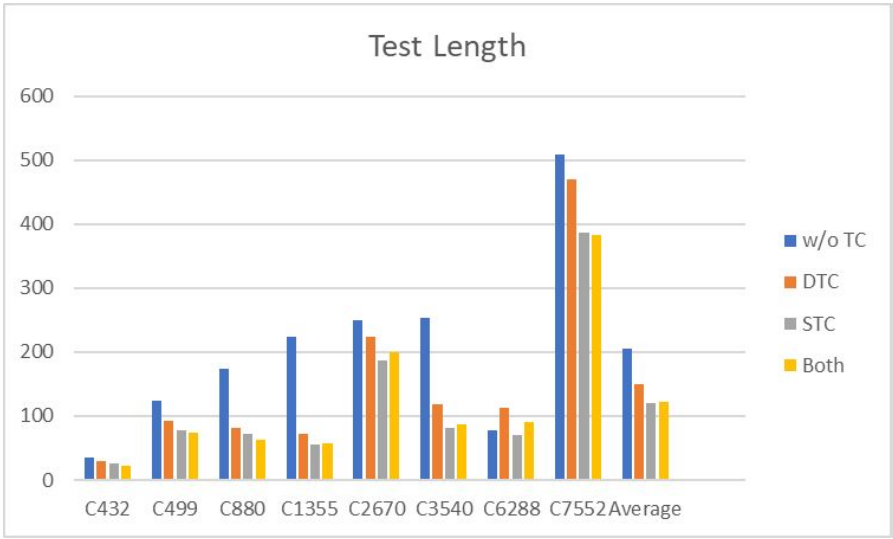
-PODEM-X Algorithm

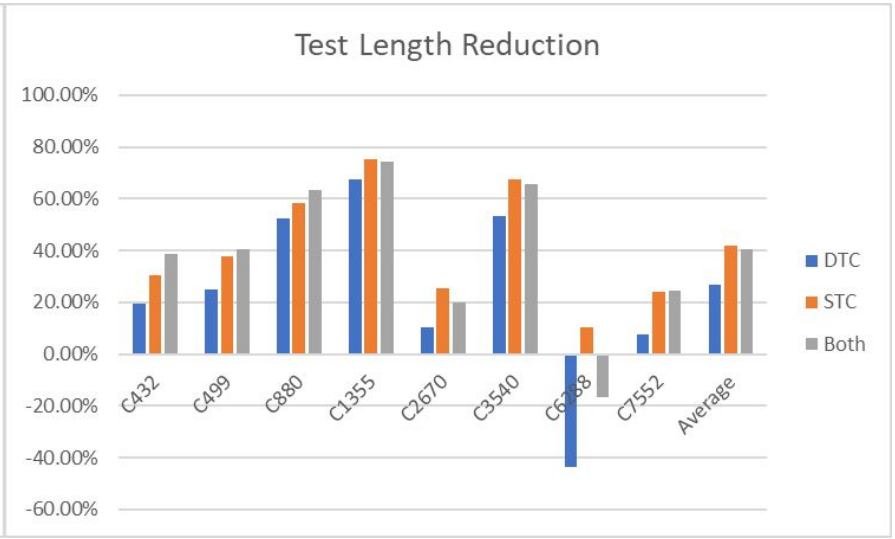
-Using BFS to backtrace from PO to find a secondary fault

Static Test Compression:

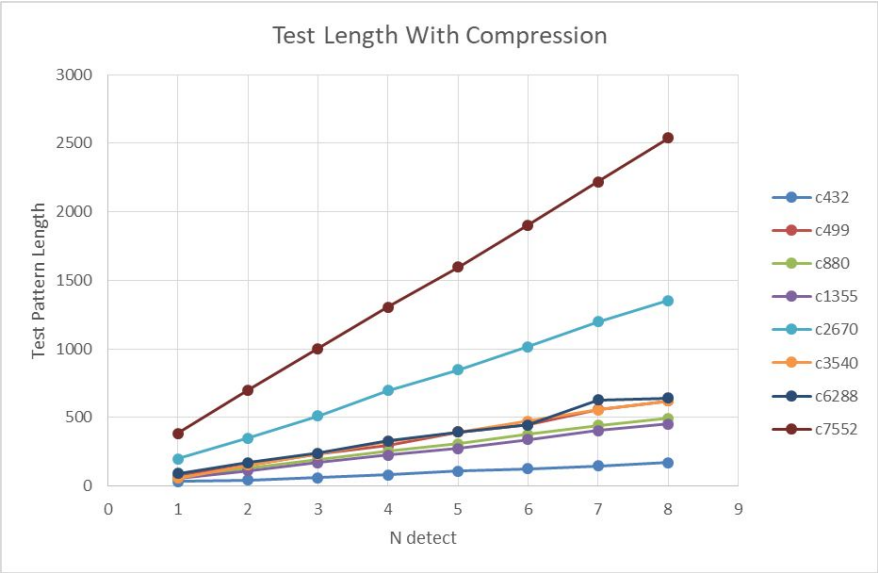
-Reverse-order fault simulation

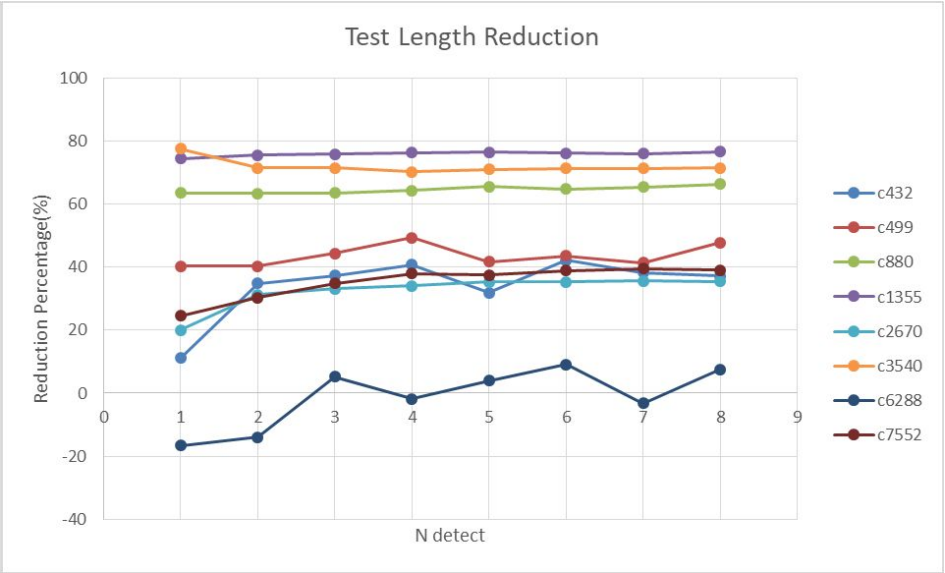
Result & comparison -DTC, STC, and both





Result & comparison - with n-detect





Conclusion

Improvements:

circuit number	Test length w/o compression	fault coverage	run time	Test length w/ compression	fault coverage	run time	Test length reduction
C432	36	11.62%	0.1	22	11.62%	0.2	38.89%
C499	124	89.25%	0.8	74	89.54%	1.3	40.32%
C880	173	50.00%	0.6	63	48.95%	0.9	63.58%
C1355	223	37.20%	3.5	57	37.23%	3.4	74.44%
C2670	250	91.89%	1.8	200	91.75%	2.3	20.00%
C3540	254	22.59%	17.5	87	22.38%	34.2	65.75%
C6288	78	97.31%	5.5	91	97.38%	15.1	-16.67%
C7552	508	97.67%	8.1	383	97.72%	13.8	24.61%
Average	205.75	62.19%	4.7375	122.125	62.07%	8.9	40.64%

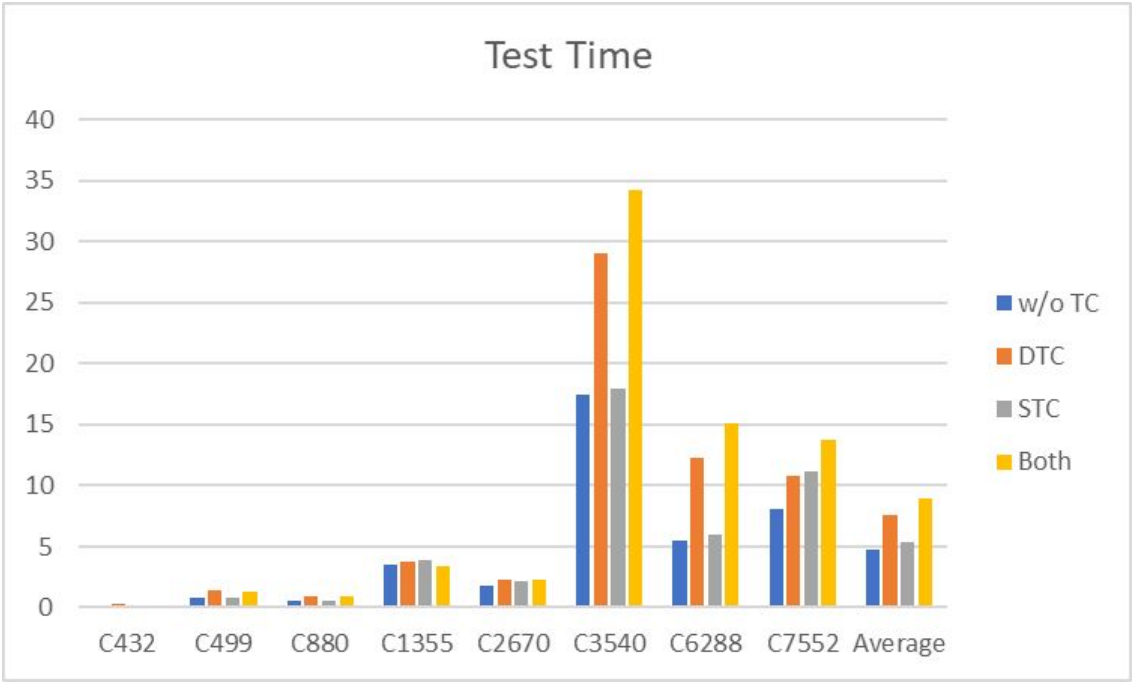
Average reduction: 40.64%
Average reduction for 8-detect: 47.64%

Conclusion

Trade off:

Length

Time



Problems we met

Different FC and even longer patterns after DTC?

-more FC: more backtrack chances

-lower FC: maybe bug? Still fixing……