Covering Arrays Generation

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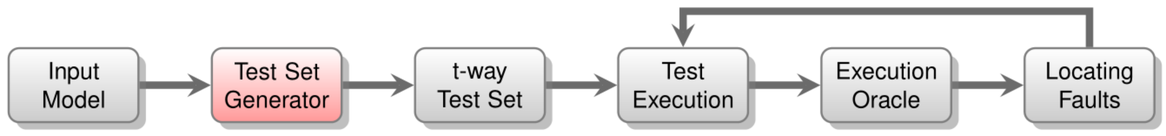
Combinatorial Test Set Generation

Combinatorial Testing

- Combinatorial Testing allows for efficient testing of large systems while maintaining certain coverage guarantees.
- In a combinatorial test set, every t-way interaction appears in at least λ tests, where t is called the strength and λ the index.
- In practice, greedy algorithms have proven the most versatile approach and are therefore used in many combinatorial test generators.



Requirements for Combinatorial Test Generation Tools:

- Fast generation
- Small number of tests
- Easy to use
- Many different features

FIPOG and Tie-Breaker Evaluation

Various algorithmic and implementation-level improvements to the well-known In-Parameter-Order family of algorithms, including

- Simultaneous coverage gain computation.
- Skipping of fully covered column configurations.
- Partitioning of suitability checks.
- Compile-time strength.

Result: Vastly improved generation times.

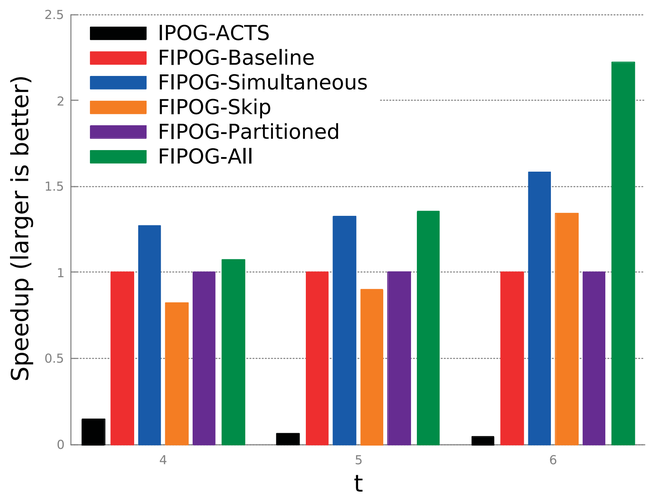
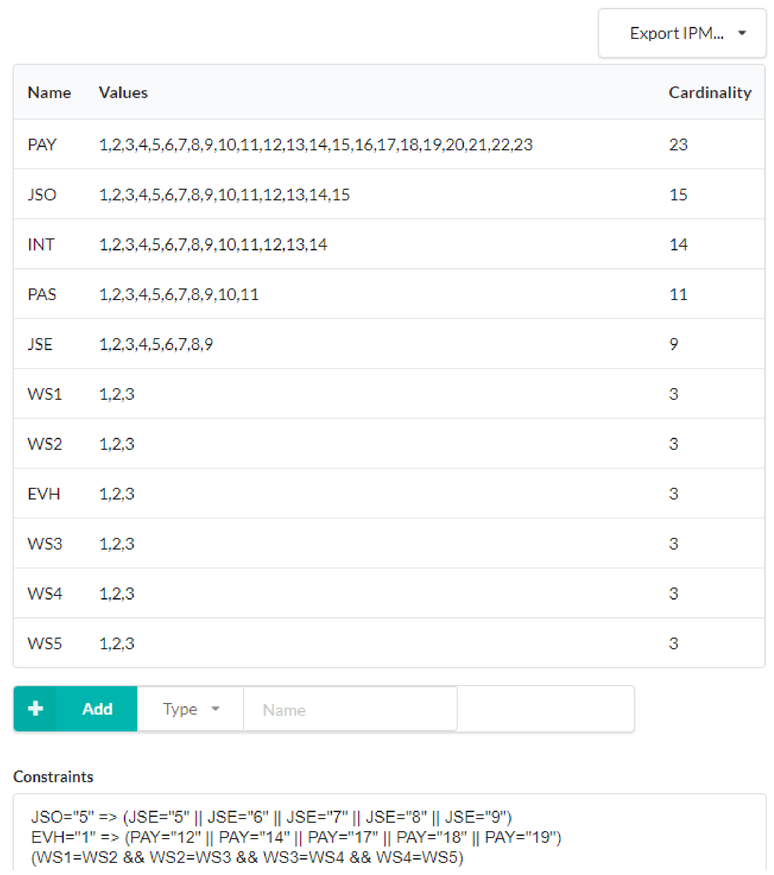


Figure 1: Speedup of FIPOG compared to the ACTS implementation of IPOG

- Further, different tie-breaking strategies were evaluated.

The CAgen Web GUI



- In the Input Parameter Model tab, the model can be edited.

CAgen: A tool for Fast t-Way Test Set Generation

- t-way test set generation up to strength $t = 8$.
- Implements the FIPOG, FIPOG-F and FIPOG-F2 algorithms.
- Support for constraints.
- Generation of test sets of higher index.
- Various export and import options.
- Compatible with other generation tools.
- Freely available as Web GUI and CLI at `https://matris.sba-research.org/tools/cagen`.

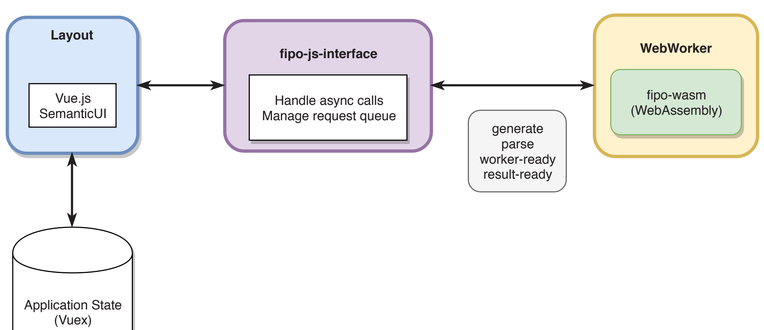


Figure 2: The architecture behind CAgen

Future Work and HPC

Optimization Algorithms

- Devise new metaheuristic algorithms, mathematical constructions and post-optimization methods for CA generation.
- Combine our experience in the field to devise efficient hybrid heuristics.
  - Enhance greedy algorithms using metaheuristics.
  - Combine mathematical constructions and reductions with other generation techniques.
  - Use Artificial Intelligence to enhance heuristic methods.
  - Develop a hyper-heuristic framework.

High Performance Computing

- Develop scalable parallel algorithms.
- Use super computing for constructing combinatorial test sets.

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