Combinatorial Decision Making and Optimization

Project Report

VLSI Design

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1 CP (Rotation)

The rotational CP model is one where rotation of the circuits is allowed. A global constraint that allows for the rotation of circuits has been used to build a generalisable model.

1.1 Considerations on the Height

By assuming that no gaps are allowed between the circuits, the min height is obtained by taking the sum of the circuits' area and dividing it by the given max width.

If gaps are allowed between the circuits, a model using the `cumulative` constraint can be used to first minimise the board's height. After finding the minimum height, it can then be applied to a second model using the `geost_smallest_bb` constraint.

1.2 Circuits' Rotations

Circuits with widths and heights that are equivalent do not have any rotations assigned to them. This reduces the number of total solutions as square-shaped circuits occupy the same relative area regardless of orientation.

1.3 Constraints

- A `geost_smallest_bb` constraint is used to pack the circuits with rotations allowed into the board without gaps.

```
constraint geost_smallest_bb(
    k,
    rect_size,
    rect_offset,
    shape,
    x,
    kind,
    l,
    u
);
```

- A `forall` constraint is used to ensure that only shapes with certain rotations are accepted as valid.

```
constraint forall(obj in OBJECTS)(
    kind[obj] in valid_shapes[obj]
);
```

- A search strategy using `most_constrained` and `indomain_min` is applied to the rotation of the circuits.

1.4 Final Considerations

The final model is able to solve 17/40 instances with a time constraint of 300 seconds.

A search strategy using `most_constrained` and `indomain_min` was also tested on the circuits' coordinates.

However, this only led to a worsening of the model's performance and hence, was not included in the final model.