On Channel Restructuring for Complete FIFO Recovery
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On Channel Restructuring for Complete FIFO Recovery

Focus: Dataflow models as an intermediate representation for High-Level Synthesis
Challenge: Recover FIFO channels after code restructuring
Contributions: HLS algorithm for channel restructuring + Dataflow model to ensure completeness

1) Polyhedral Process Networks

\[
\text{for } i = 0 \text{ to } N + 1
\]
\[
\text{load}(a[i, i]);
\]
\[
\text{for } i = 1 \text{ to } T
\]
\[
\text{for } j = 1 \text{ to } N
\]
\[
a[i, j] :=
\]
\[
a[i - 1, i - 1] + a[i - 1, j] + a[i - 1, i + 1];
\]
\[
\text{for } i = 1 \text{ to } N
\]
\[
\text{store}(a[T, i]);
\]

Challenge addressed: Channel synthesis

2) Data-aware Process Networks

Features:
- PPN partitioning based on loop tiling
- Incoming dependences (1,2,3) are loaded
- Outgoing dependences (13,14,15) are stored
- Internal dependences (4 to 12) are solved through local channels

3) Our FIFO Recovery Algorithm

4) Experimental Results

<table>
<thead>
<tr>
<th>Kernel</th>
<th>DPN FIFO</th>
<th>PPN FIFO</th>
<th>DPN with tiling FIFO</th>
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Experimental setup:
- We have run our algorithm on the kernels of PolyBench/C v3.2
- We have checked the completeness of our algorithm on PPN with DPN partitioning (DPN)
- We have studied the behavior of our algorithm on general PPN, without DPN partitioning (PPN with tiling).

Theorem: FIFO recovery is complete on our DPN model

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