

# Conflict-Free Parallel Memory Access Scheme For FFT Processors

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Texas Instruments

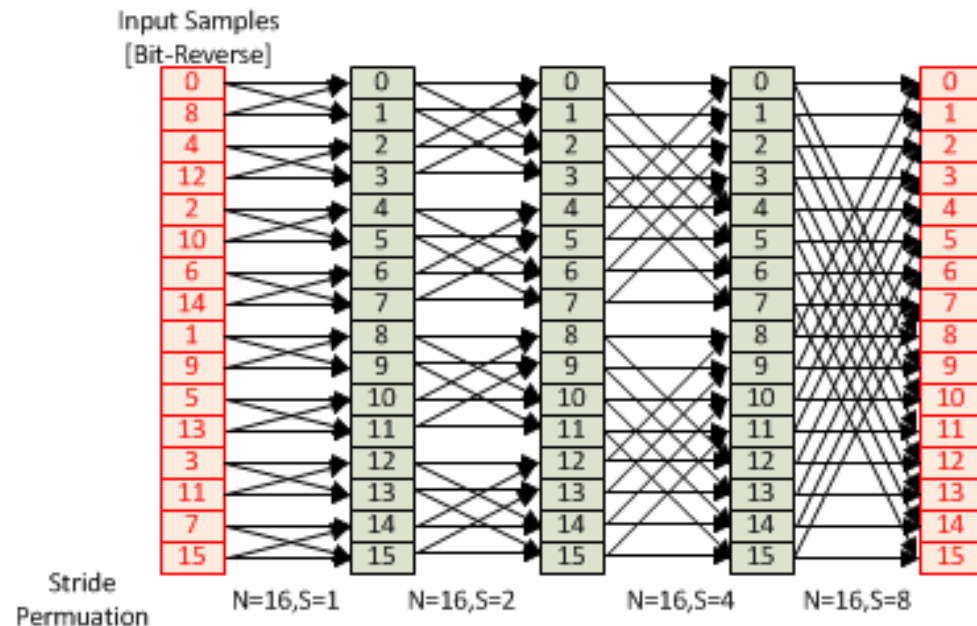
Reference:

Jarmo H. Takale, etc.

Published at ISCAS '03. Proceedings of the 2003 International Symposium on Circuits and Systems, 2003.

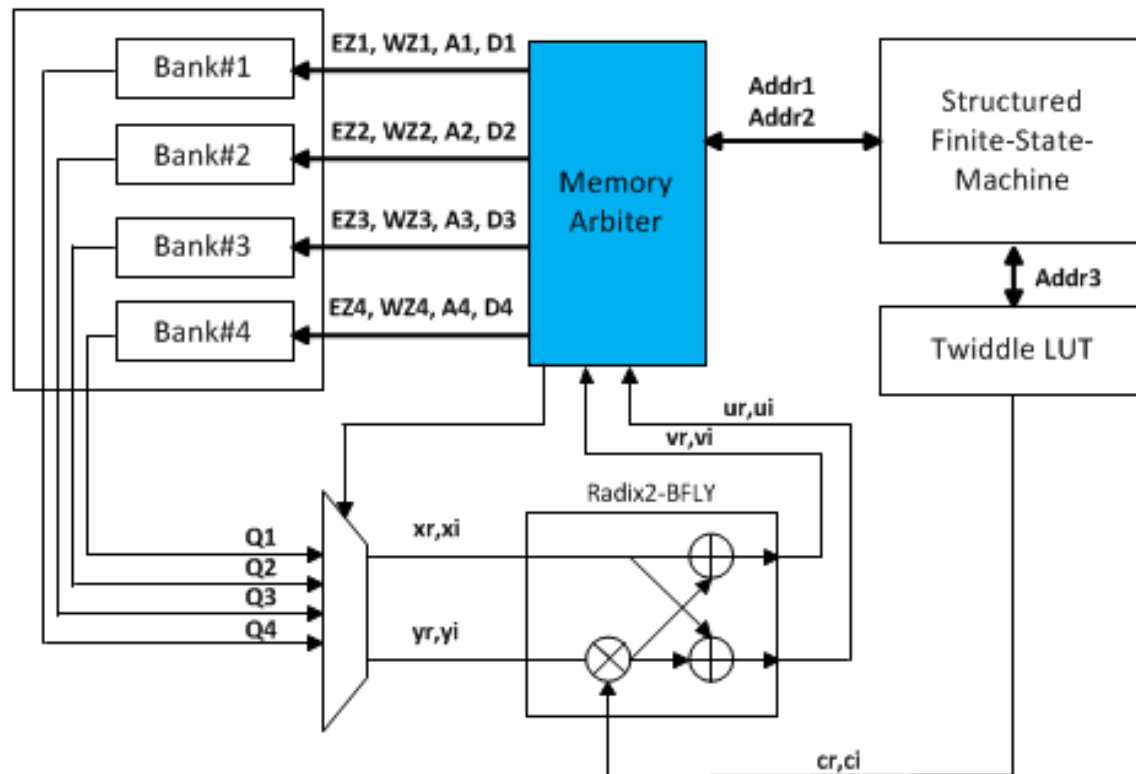
# 16-Point FFT Example

- Problem
  - Given Stride-Permutation pattern, WHAT is the address generation scheme to avoid access conflict?



# N=16, 4-Bank FFT Core Architecture

- One possible architecture
  - Key algorithm challenge is to find out memory arbiter (blue-box).



# From the paper

- Given the address from state-machine (Stride-Permutation Index), bank ID and address is provided as follows.

**Given Address, Row Address(2-bit) / Bank Select(2-bit)**

<b>{0, 0},</b>	<b>// 0</b>
<b>{0, 1},</b>	<b>// 1</b>
<b>{0, 2},</b>	<b>// 2</b>
<b>{0, 3},</b>	<b>// 3</b>
<b>{1, 1},</b>	<b>// 4</b>
<b>{1, 0},</b>	<b>// 5</b>
<b>{1, 3},</b>	<b>// 6</b>
<b>{1, 2},</b>	<b>// 7</b>
<b>{2, 2},</b>	<b>// 8</b>
<b>{2, 3},</b>	<b>// 9</b>
<b>{2, 0},</b>	<b>// 10</b>
<b>{2, 1},</b>	<b>// 11</b>
<b>{3, 3},</b>	<b>// 12</b>
<b>{3, 2},</b>	<b>// 13</b>
<b>{3, 1},</b>	<b>// 14</b>
<b>{3, 0},</b>	<b>// 15</b>

# How it works?

- FFT stage #0 (N=16, 4-bank memory)
- Stride-Permutation (N=16, S=1)

**Given Address, Row Address(2-bit) / Bank**

**Select(2-bit) {Address, Select}**

```

{0, 0}, // 0
{0, 1}, // 1
{0, 2}, // 2
{0, 3}, // 3
{1, 1}, // 4
{1, 0}, // 5
{1, 3}, // 6
{1, 2}, // 7
{2, 2}, // 8
{2, 3}, // 9
{2, 0}, // 10
{2, 1}, // 11
{3, 3}, // 12
{3, 2}, // 13
{3, 1}, // 14
{3, 0}, // 15
    
```

Stride-Permutation Index	
(0, 1)	Bank0, Bank1
(2, 3)	Bank2, Bank3
(4, 5)	Bank1, Bank0
(6, 7)	Bank3, Bank2
(8, 9)	Bank2, Bank3
(10, 11)	Bank0, Bank1
(12, 13)	Bank3, Bank2
(14, 15)	Bank1, Bank0

# How it works?

- FFT stage #3 (N=16, 4-bank memory)
- Stride-Permutation (N=16, S=8)

**Given Address, Row Address(2-bit) / Bank**

**Select(2-bit) {Address, Select}**

{0, 0}, // 0  
{0, 1}, // 1  
{0, 2}, // 2  
{0, 3}, // 3  
{1, 1}, // 4  
{1, 0}, // 5  
{1, 3}, // 6  
{1, 2}, // 7  
{2, 2}, // 8  
{2, 3}, // 9  
{2, 0}, // 10  
{2, 1}, // 11  
{3, 3}, // 12  
{3, 2}, // 13  
{3, 1}, // 14  
{3, 0}, // 15

Stride-Permutation Index	
(0, 8)	Bank0, Bank2
(1, 9)	Bank1, Bank3
(2, 10)	Bank2, Bank0
(3, 11)	Bank3, Bank1
(4, 12)	Bank1, Bank3
(5, 13)	Bank0, Bank2
(6, 14)	Bank3, Bank1
(7, 15)	Bank2, Bank0