EPLE Algorithmic Elaboration Analysis Report

EPLE Automated Analysis System

2025-09-15 17:39:18

1 Overview

Computational Patterns Detected: 2
Algorithmic Elaborations Found: 16
MUD Diagrams Generated: 19

2 Computational Patterns

Pattern	Type	Usage Count
base_decomposition	decomposition	4
incremental_counting	counting	5

3 Key Algorithmic Elaborations

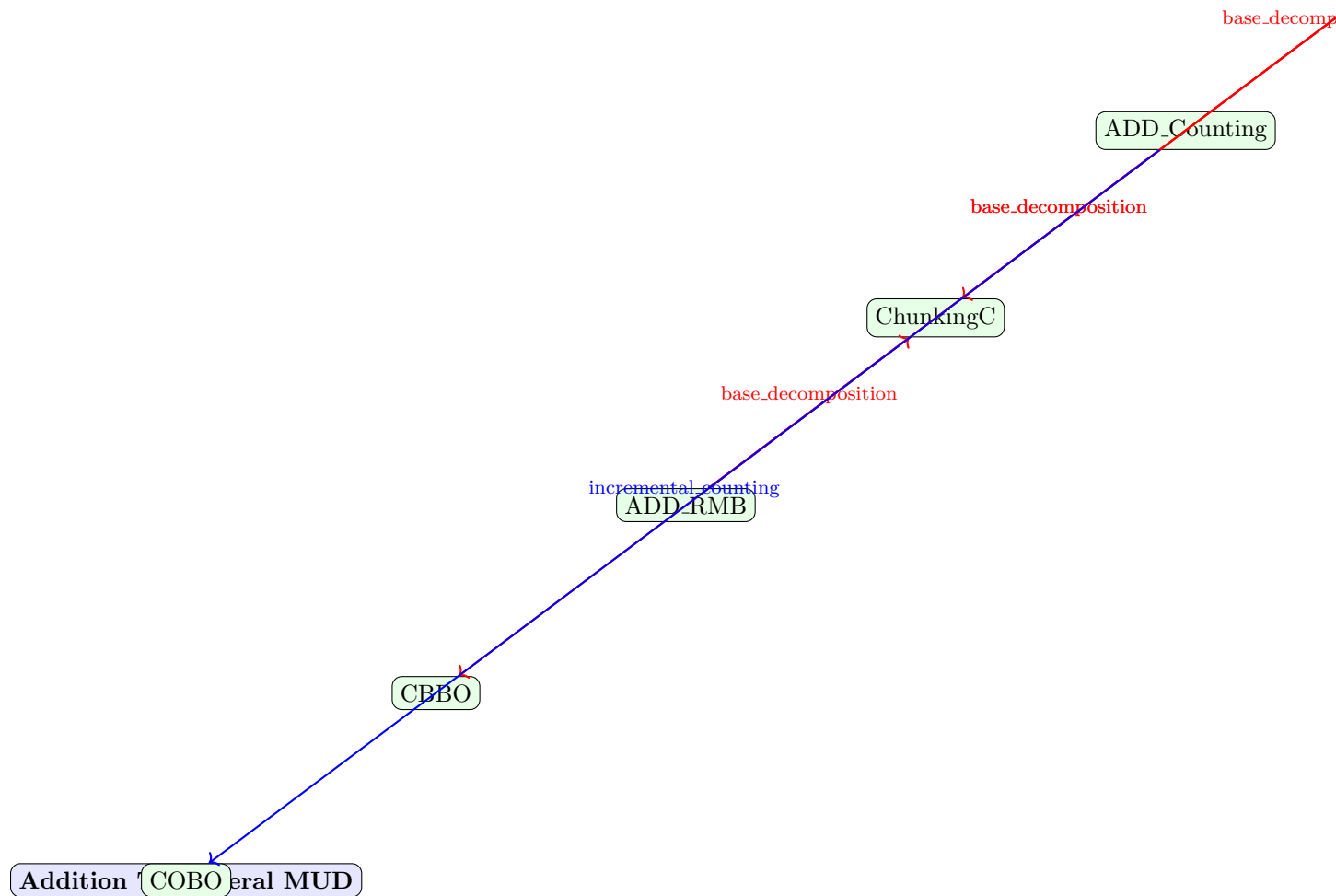| Base Strategy	Elaborated Strategy	Shared Patterns	Confidence
ADD_Rounding	SUB_Rounding	base_decomposition	1.00
ADD_Rounding	SMR_DIV_CGOB	base_decomposition	1.00
ADD_Rounding	SMR_DIV_DealingByOnes	base_decomposition	1.00
ADD_Counting	ADD_Chunking	incremental_counting	1.00
ADD_Counting	ADD_COBO	incremental_counting	1.00
ADD_Counting	COBO	incremental_counting	1.00
ADD_Counting	SMR_MULT_C2C	incremental_counting	1.00
ADD_Chunking	ADD_COBO	incremental_counting	1.00
ADD_Chunking	COBO	incremental_counting	1.00
ADD_Chunking	SMR_MULT_C2C	incremental_counting	1.00

4 Meaning-Use Diagrams

The following diagrams illustrate the algorithmic elaborations detected in the analysis. Each diagram shows strategies connected by shared computational patterns.

4.1 Addition To General

Operation: Addition To General
Strategies Analyzed: 7
Elaborations Detected: 6

base_decomp

ADD_Counting

base_decomposition

ChunkingC

base_decomposition

incremental_counting

ADD_RMB

CBBO

Addition **COBO** **eral MUD**

Summary:

```
Automated MUD Analysis for Addition To General
============================================================
Total strategies analyzed: 7
Total elaborations detected: 6

Key Patterns Identified:
  • base_decomposition: 5 relationships
  • incremental_counting: 1 relationships

Notable Elaborations:
```
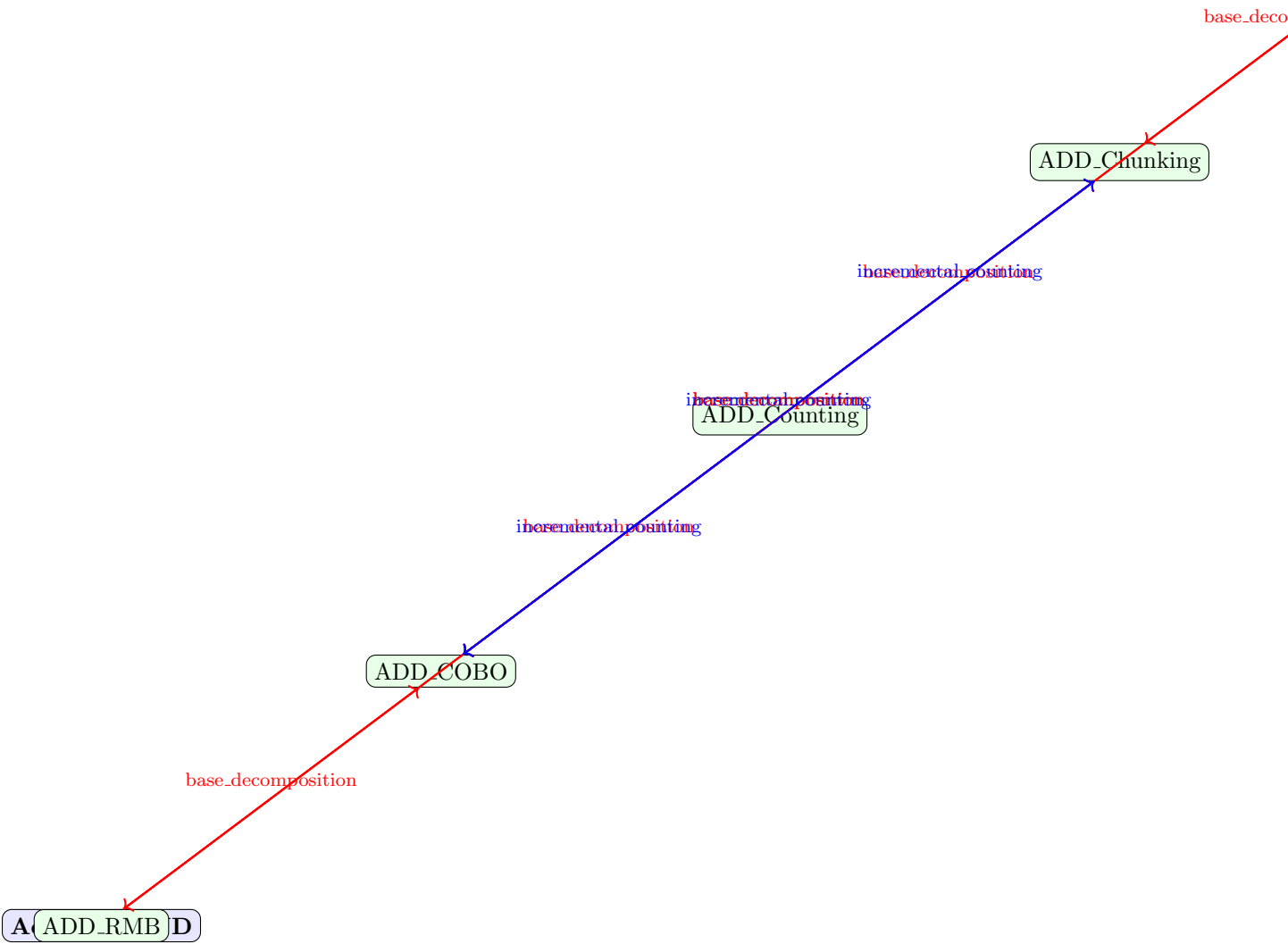
- ADD_Rounding → CBBO
  Shared: base_decomposition (confidence: 1.00)
- ADD_Rounding → ChunkingC
  Shared: base_decomposition (confidence: 1.00)
- ADD_Rounding → ChunkingB
  Shared: base_decomposition (confidence: 1.00)
- ADD_Counting → COBO
  Shared: incremental_counting (confidence: 1.00)
- ADD_RMB → ChunkingC
  Shared: base_decomposition (confidence: 1.00)
- ... and 1 more high-confidence relationships

4.2 Addition

Operation: Addition
Strategies Analyzed: 5
Elaborations Detected: 8

base_deco

ADD_Chunking

baseundecahpositmng

incremental_counting

ADD_Counting

baseundecahpositmng

incremental_counting

baseundecahpositmng

incremental_counting

ADD_COBO

base_decomposition

A ADD_RMB **D**

Summary:

```
Automated MUD Analysis for Addition
=============================================================
Total strategies analyzed: 5
Total elaborations detected: 8

Key Patterns Identified:
```
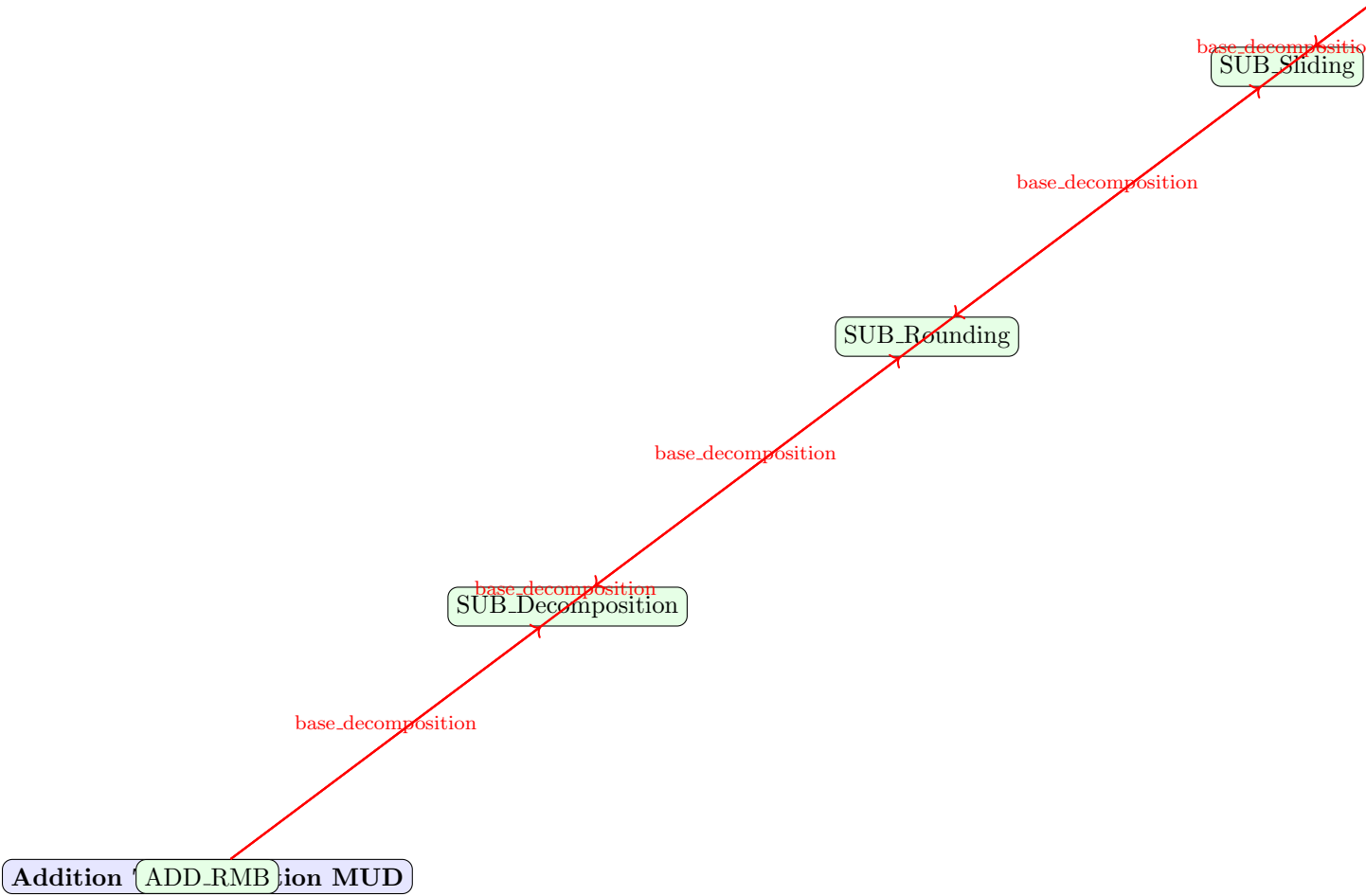
- base_decomposition: 6 relationships
- incremental_counting: 3 relationships

Notable Elaborations:
- ADD_Rounding → ADD_RMB
  Shared: base_decomposition (confidence: 1.00)
- ADD_Chunking → ADD_COBO
  Shared: base_decomposition, incremental_counting (confidence: 1.00)

4.3 Addition To Subtraction

Operation: Addition To Subtraction
Strategies Analyzed: 5
Elaborations Detected: 6

Summary:

```
Automated MUD Analysis for Addition To Subtraction
==============================================================
Total strategies analyzed: 5
Total elaborations detected: 6

Key Patterns Identified:
```

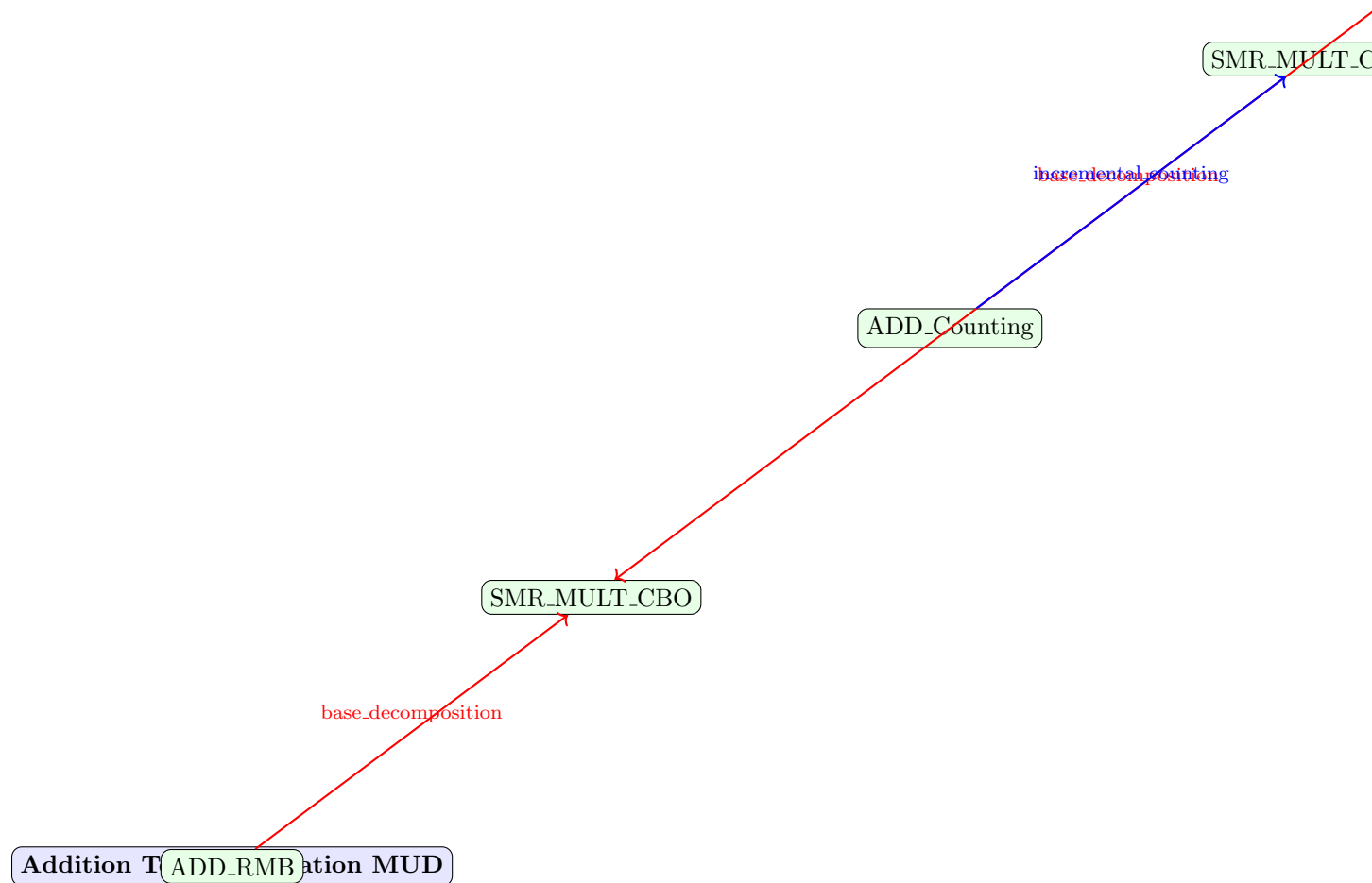- base_decomposition: 6 relationships

Notable Elaborations:
- ADD_Rounding → SUB_Sliding
  Shared: base_decomposition (confidence: 1.00)
- ADD_Rounding → SUB_Decomposition
  Shared: base_decomposition (confidence: 1.00)
- ADD_Rounding → SUB_Rounding
  Shared: base_decomposition (confidence: 1.00)
- ADD_RMB → SUB_Sliding
  Shared: base_decomposition (confidence: 1.00)
- ADD_RMB → SUB_Decomposition
  Shared: base_decomposition (confidence: 1.00)
- ... and 1 more high-confidence relationships

4.4 Addition To Multiplication

Operation: Addition To Multiplication
Strategies Analyzed: 5
Elaborations Detected: 3

SMR_MULT_C

incremental counting
base decomposition

ADD_Counting

SMR_MULT_CBO

base_decomposition

Addition T ADD_RMB ation MUD

ADD_RMB

Summary:

```
Automated MUD Analysis for Addition To Multiplication
==============================================================
Total strategies analyzed: 5
Total elaborations detected: 3

Key Patterns Identified:
```

- base_decomposition: 2 relationships
- incremental_counting: 1 relationships
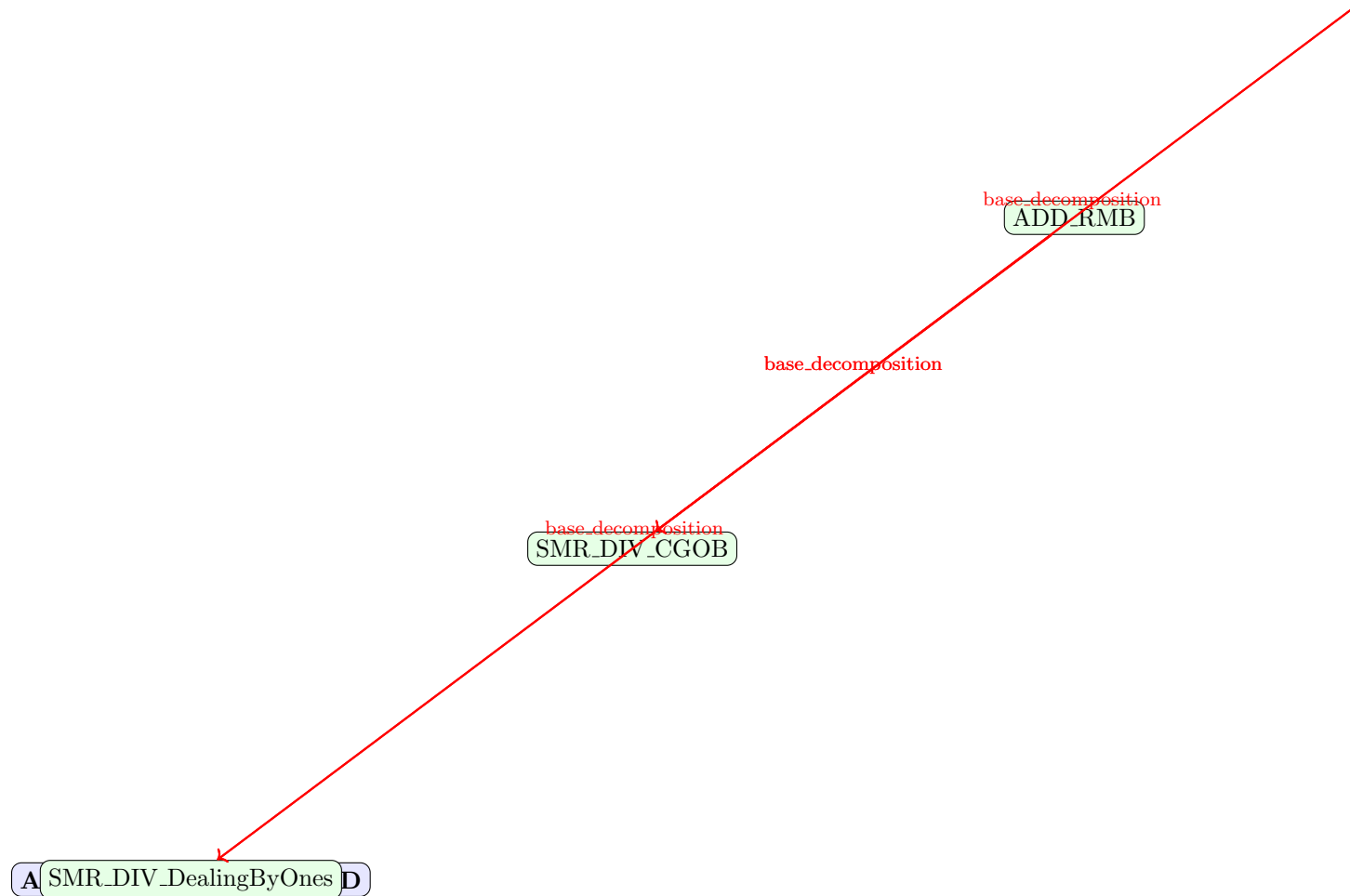
Notable Elaborations:
- ADD_Rounding → SMR_MULT_CBO
  Shared: base_decomposition (confidence: 1.00)
- ADD_Counting → SMR_MULT_C2C
  Shared: incremental_counting (confidence: 1.00)
- ADD_RMB → SMR_MULT_CBO
  Shared: base_decomposition (confidence: 1.00)

4.5 Addition To Division

Operation: Addition To Division
Strategies Analyzed: 4
Elaborations Detected: 4

base_decomposition

ADD_RMB

base_decomposition

base_decomposition

SMR_DIV_CGOB

A SMR_DIV_DealingByOnes D

Summary:

```
Automated MUD Analysis for Addition To Division
============================================================
Total strategies analyzed: 4
Total elaborations detected: 4

Key Patterns Identified:
  • base_decomposition: 4 relationships

Notable Elaborations:
```
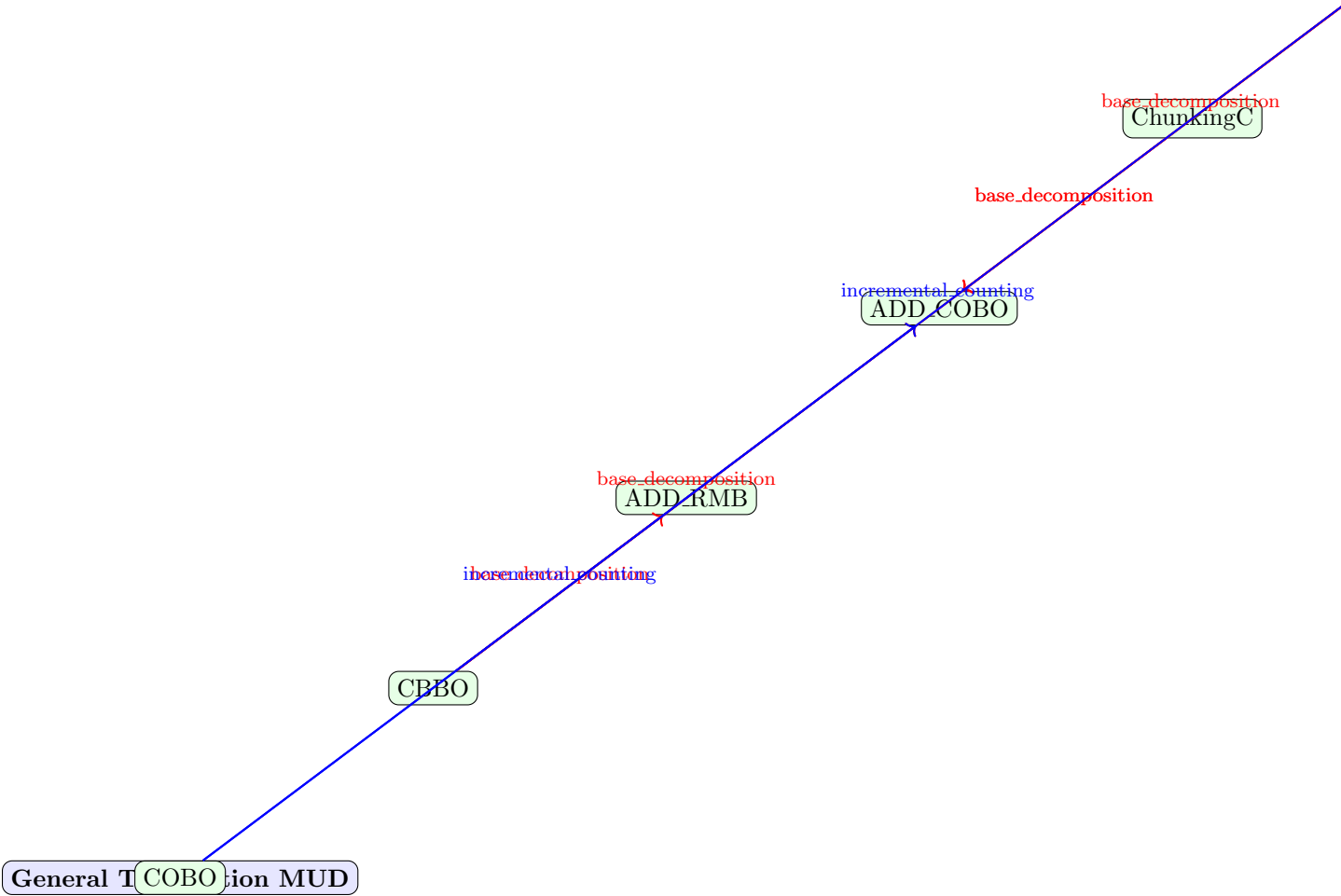
- ADD_Rounding → SMR_DIV_CGOB
  Shared: base_decomposition (confidence: 1.00)
- ADD_Rounding → SMR_DIV_DealingByOnes
  Shared: base_decomposition (confidence: 1.00)
- ADD_RMB → SMR_DIV_CGOB
  Shared: base_decomposition (confidence: 1.00)
- ADD_RMB → SMR_DIV_DealingByOnes
  Shared: base_decomposition (confidence: 1.00)

4.6   General To Addition

Operation: General To Addition
Strategies Analyzed: 7
Elaborations Detected: 9

base_decomposition
ChunkingC

base_decomposition

incremental_counting
ADD_COBO

base_decomposition
ADD_RMB

incremental_counting

CBBO

General T COBO ;ion MUD

Summary:

```
Automated MUD Analysis for General To Addition
===============================================================
Total strategies analyzed: 7
Total elaborations detected: 9
```

Key Patterns Identified:
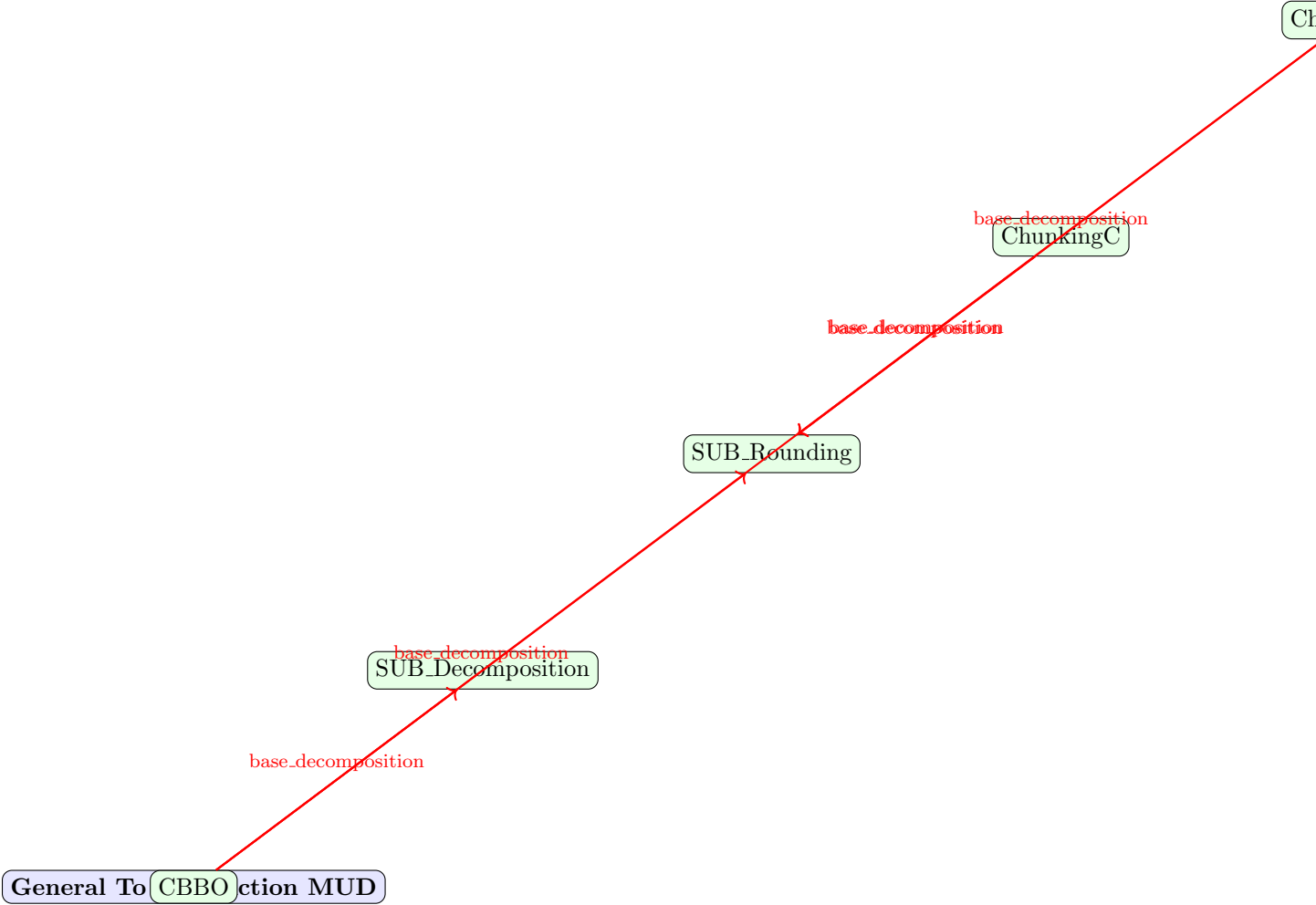- base_decomposition: 7 relationships
- incremental_counting: 2 relationships

Notable Elaborations:
- CBBO → ADD_RMB
  Shared: base_decomposition (confidence: 1.00)

4.7 General To Subtraction

Operation: General To Subtraction
Strategies Analyzed: 6
Elaborations Detected: 5

Ch

base_decomposition
ChunkingC

base_decomposition

SUB_Rounding

base_decomposition
SUB_Decomposition

base_decomposition

General To CBBO ction MUD

Summary:

```
Automated MUD Analysis for General To Subtraction
================================================================
Total strategies analyzed: 6
Total elaborations detected: 5
```

```
Key Patterns Identified:
  • base_decomposition: 5 relationships

Notable Elaborations:
  • CBBO → SUB_Sliding
    Shared: base_decomposition (confidence: 1.00)
  • CBBO → SUB_Decomposition
    Shared: base_decomposition (confidence: 1.00)
  • CBBO → SUB_Rounding
    Shared: base_decomposition (confidence: 1.00)
  • ChunkingC → SUB_Rounding
    Shared: base_decomposition (confidence: 1.00)
  • ChunkingB → SUB_Rounding
    Shared: base_decomposition (confidence: 1.00)
```
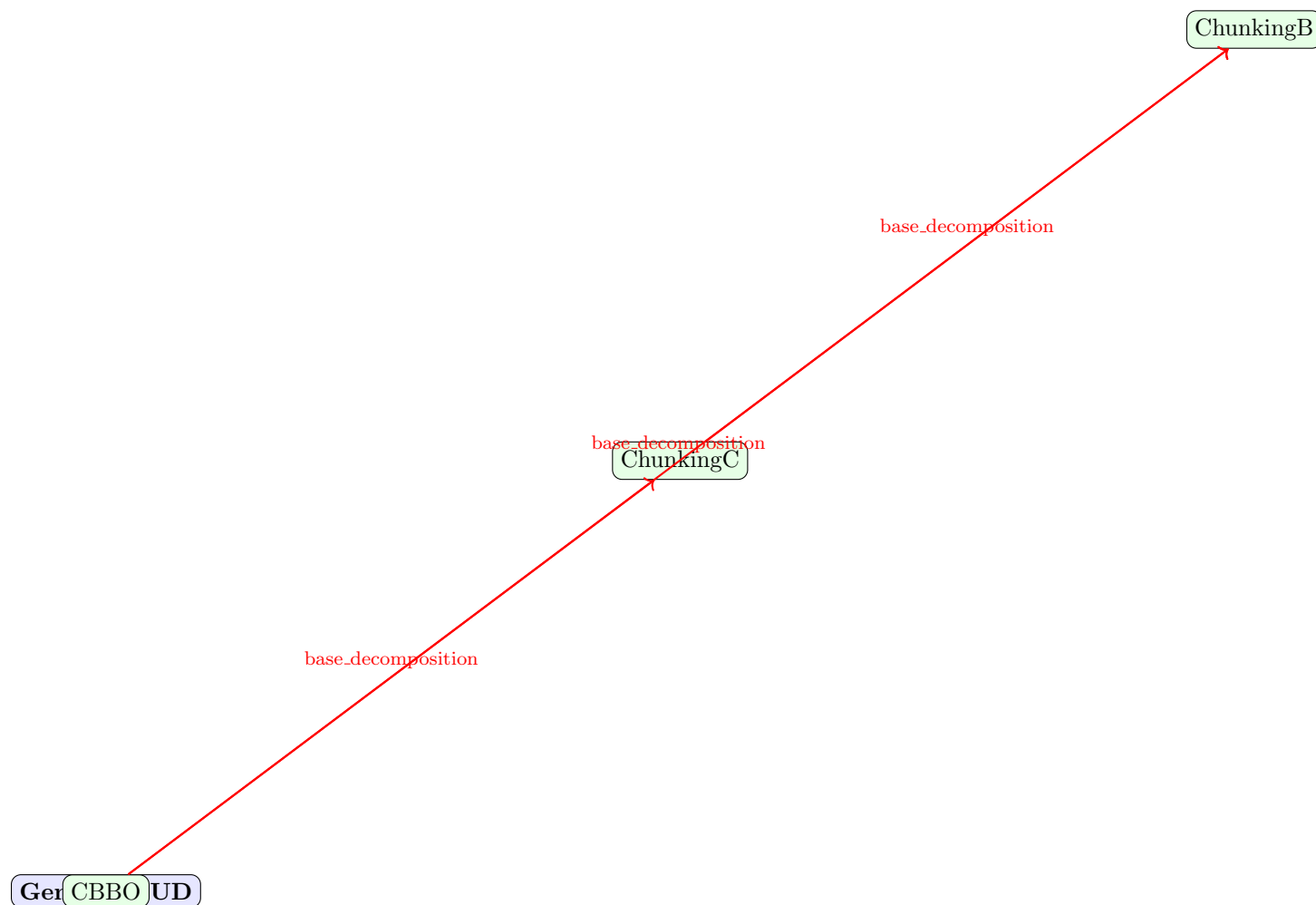
4.8 General

Operation: General
Strategies Analyzed: 3
Elaborations Detected: 3

Summary:

```
Automated MUD Analysis for General
================================================================
Total strategies analyzed: 3
Total elaborations detected: 3

Key Patterns Identified:
  • base_decomposition: 3 relationships

Notable Elaborations:
  • CBBO → ChunkingC
    Shared: base_decomposition (confidence: 1.00)
  • CBBO → ChunkingB
```
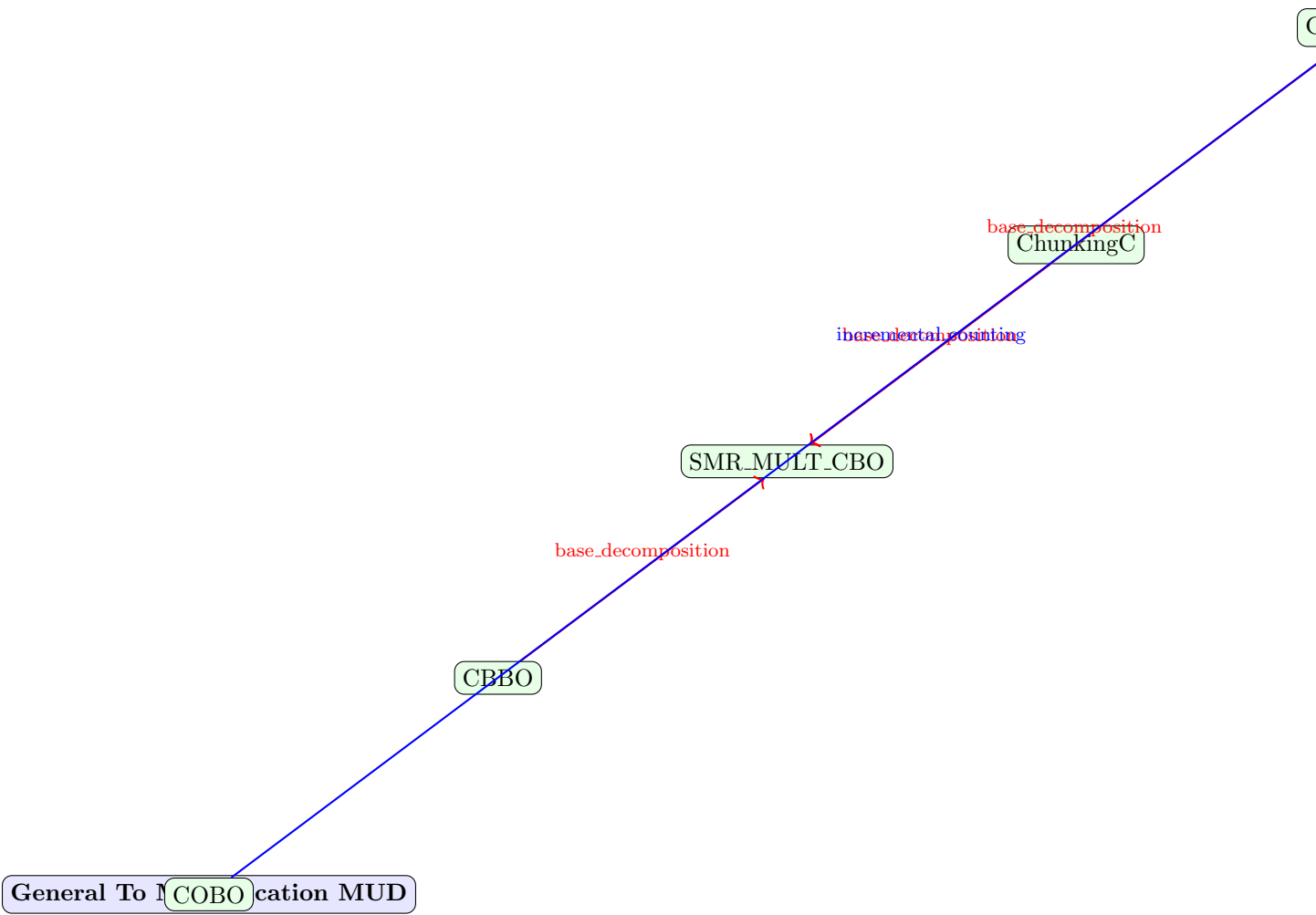
```
   Shared: base_decomposition (confidence: 1.00)
• ChunkingC → ChunkingB
   Shared: base_decomposition (confidence: 1.00)
```

4.9   General To Multiplication

Operation: General To Multiplication
Strategies Analyzed: 6
Elaborations Detected: 4

Summary:

```
Automated MUD Analysis for General To Multiplication
================================================================
Total strategies analyzed: 6
Total elaborations detected: 4
```
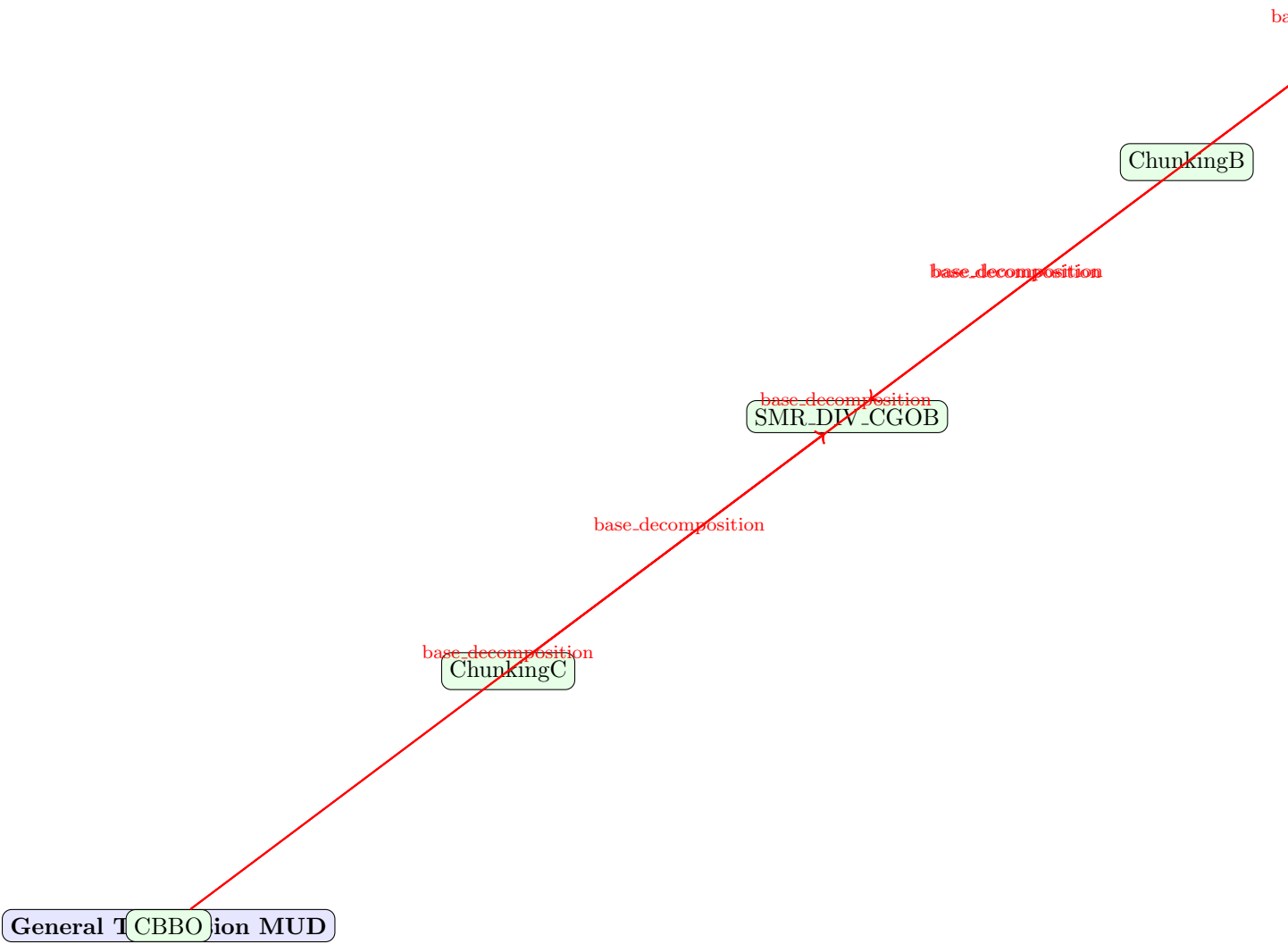
```
Key Patterns Identified:
 • base_decomposition: 3 relationships
 • incremental_counting: 1 relationships

Notable Elaborations:
 • CBBO → SMR_MULT_CBO
   Shared: base_decomposition (confidence: 1.00)
 • COBO → SMR_MULT_C2C
   Shared: incremental_counting (confidence: 1.00)
 • ChunkingC → SMR_MULT_CBO
   Shared: base_decomposition (confidence: 1.00)
 • ChunkingB → SMR_MULT_CBO
   Shared: base_decomposition (confidence: 1.00)
```

4.10   General To Division

Operation: General To Division
Strategies Analyzed: 5
Elaborations Detected: 6

ChunkingB

base_decomposition

base_decomposition

SMR_DIV_CGOB

base_decomposition

base_decomposition

ChunkingC

base_decomposition

General T CBBO ion MUD

Summary:

```
Automated MUD Analysis for General To Division
==============================================================
Total strategies analyzed: 5
Total elaborations detected: 6

Key Patterns Identified:
```

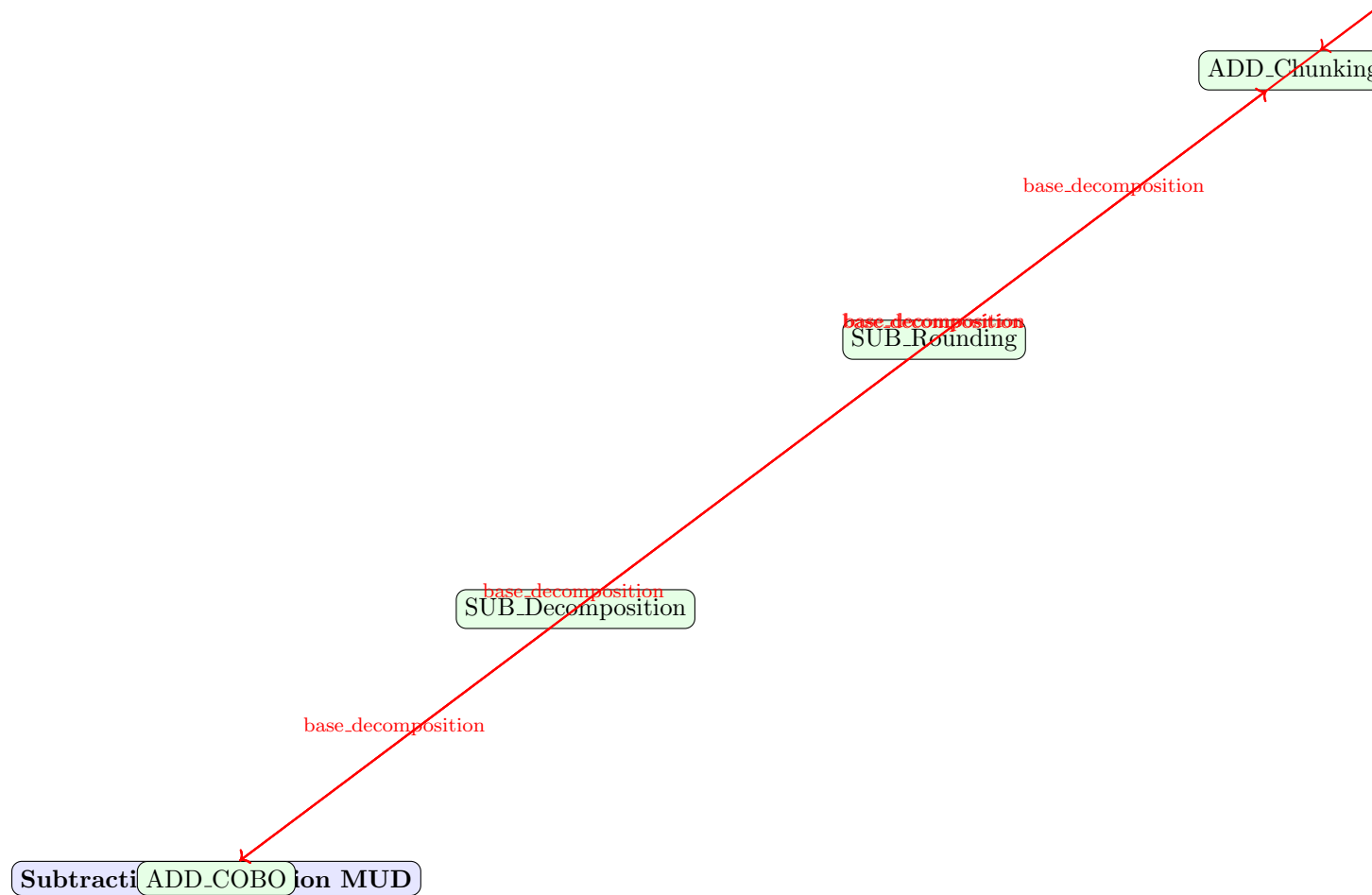- base_decomposition: 6 relationships

Notable Elaborations:
- CBBO → SMR_DIV_CGOB
  Shared: base_decomposition (confidence: 1.00)
- CBBO → SMR_DIV_DealingByOnes
  Shared: base_decomposition (confidence: 1.00)
- ChunkingC → SMR_DIV_CGOB
  Shared: base_decomposition (confidence: 1.00)
- ChunkingC → SMR_DIV_DealingByOnes
  Shared: base_decomposition (confidence: 1.00)
- ChunkingB → SMR_DIV_CGOB
  Shared: base_decomposition (confidence: 1.00)
- ... and 1 more high-confidence relationships

4.11 Subtraction To Addition

Operation: Subtraction To Addition
Strategies Analyzed: 5
Elaborations Detected: 6

ADD_Chunking

base_decomposition

base_decomposition
SUB_Rounding

base_decomposition
SUB_Decomposition

base_decomposition

Subtracti ADD_COBO ion MUD

Summary:

```
Automated MUD Analysis for Subtraction To Addition
================================================================
Total strategies analyzed: 5
Total elaborations detected: 6

Key Patterns Identified:
```
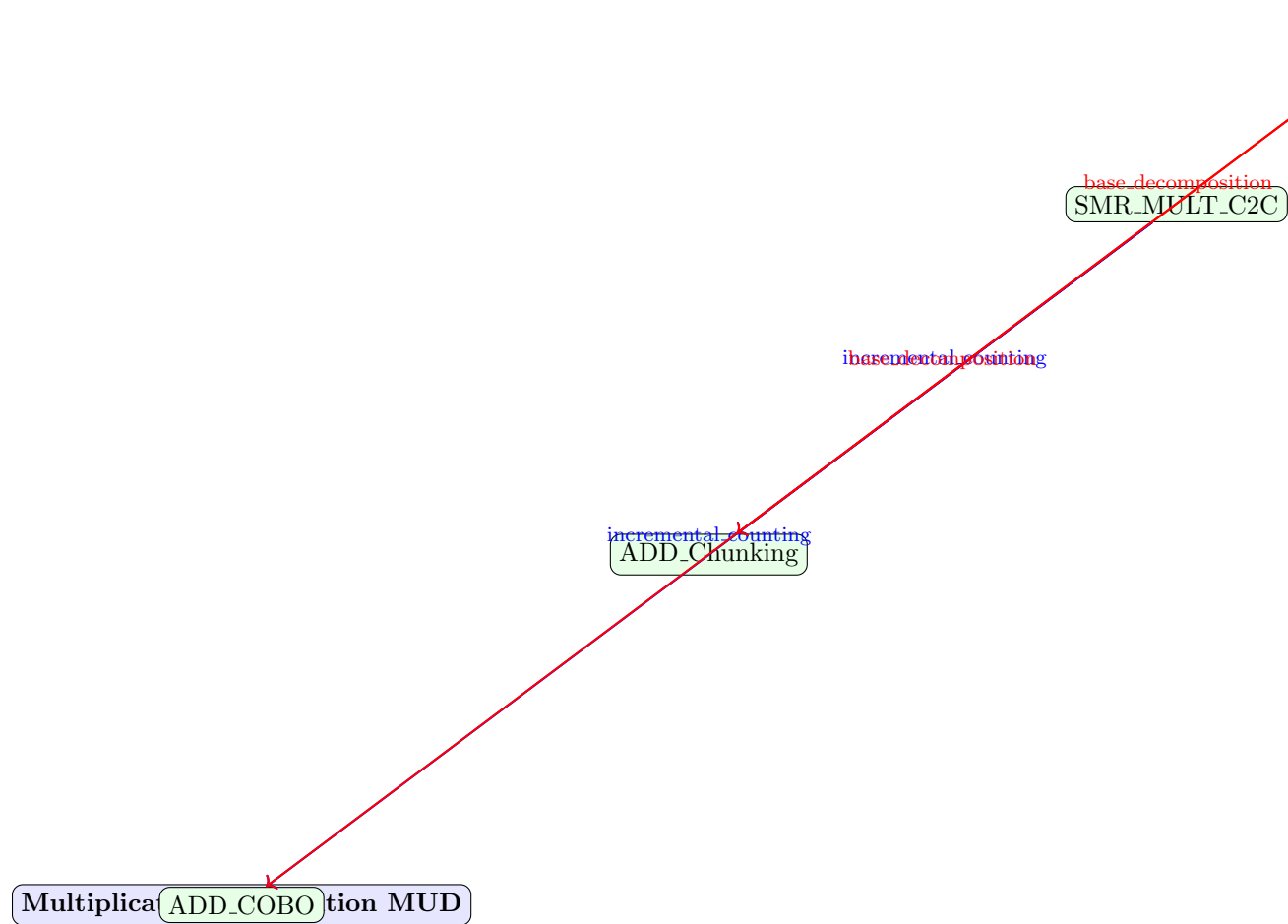
- base_decomposition: 6 relationships

Notable Elaborations:

4.12   Multiplication To Addition

Operation: Multiplication To Addition
Strategies Analyzed: 4
Elaborations Detected: 4

base_decomposition
SMR_MULT_C2C

incremental_counting

incremental_counting
ADD_Chunking

Multiplica ADD_COBO tion MUD

Summary:

```
Automated MUD Analysis for Multiplication To Addition
================================================================
Total strategies analyzed: 4
Total elaborations detected: 4

Key Patterns Identified:
    • incremental_counting: 2 relationships
    • base_decomposition: 2 relationships
```
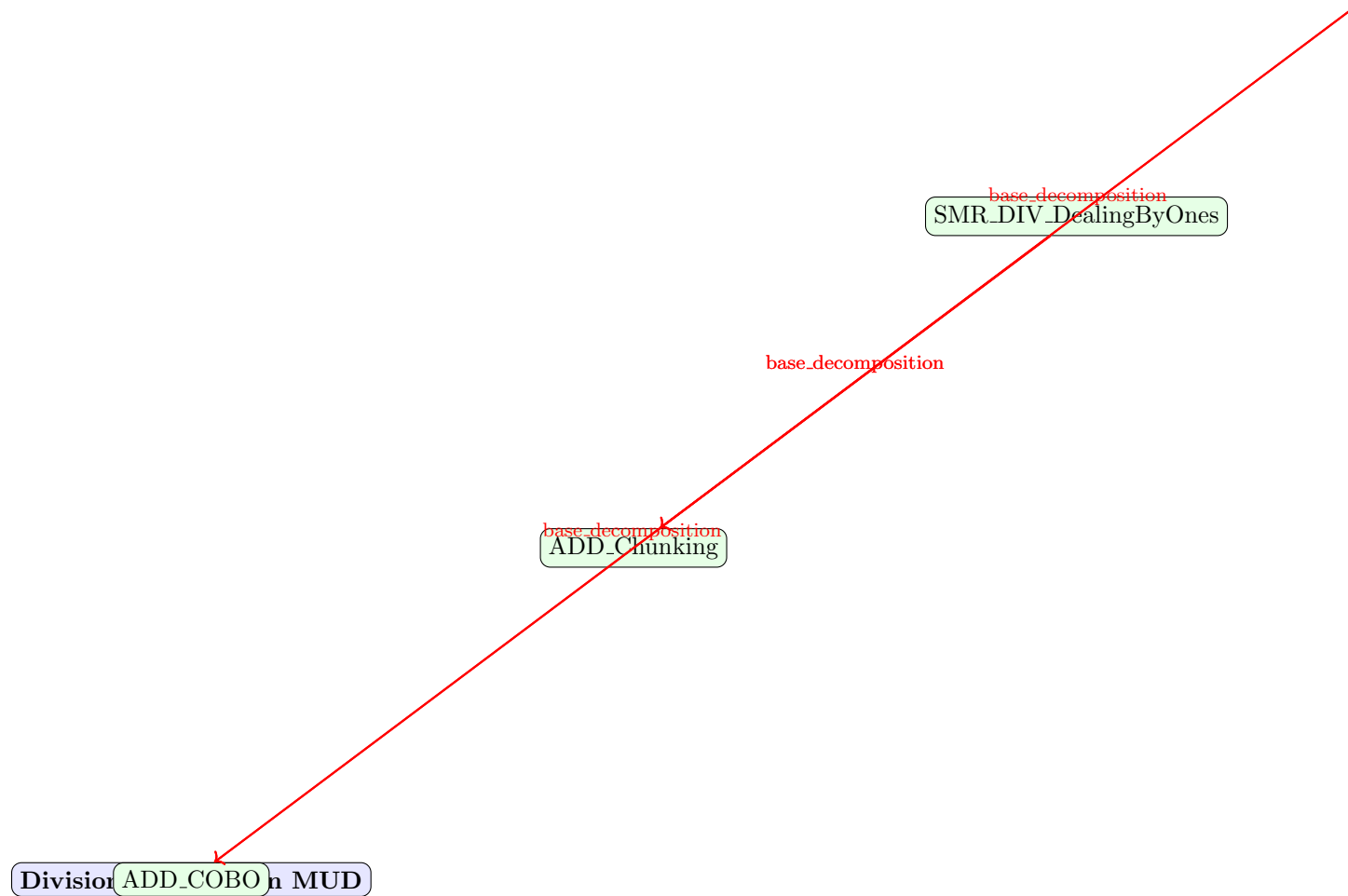
Notable Elaborations:

4.13 Division To Addition

Operation: Division To Addition
Strategies Analyzed: 4
Elaborations Detected: 4

SMR_DIV_DealingByOnes

base_decomposition

base_decomposition

base_decomposition
ADD_Chunking

Division ADD_COBO n MUD

ADD_COBO

Summary:

```
Automated MUD Analysis for Division To Addition
================================================================
Total strategies analyzed: 4
Total elaborations detected: 4

Key Patterns Identified:
  • base_decomposition: 4 relationships

Notable Elaborations:
```
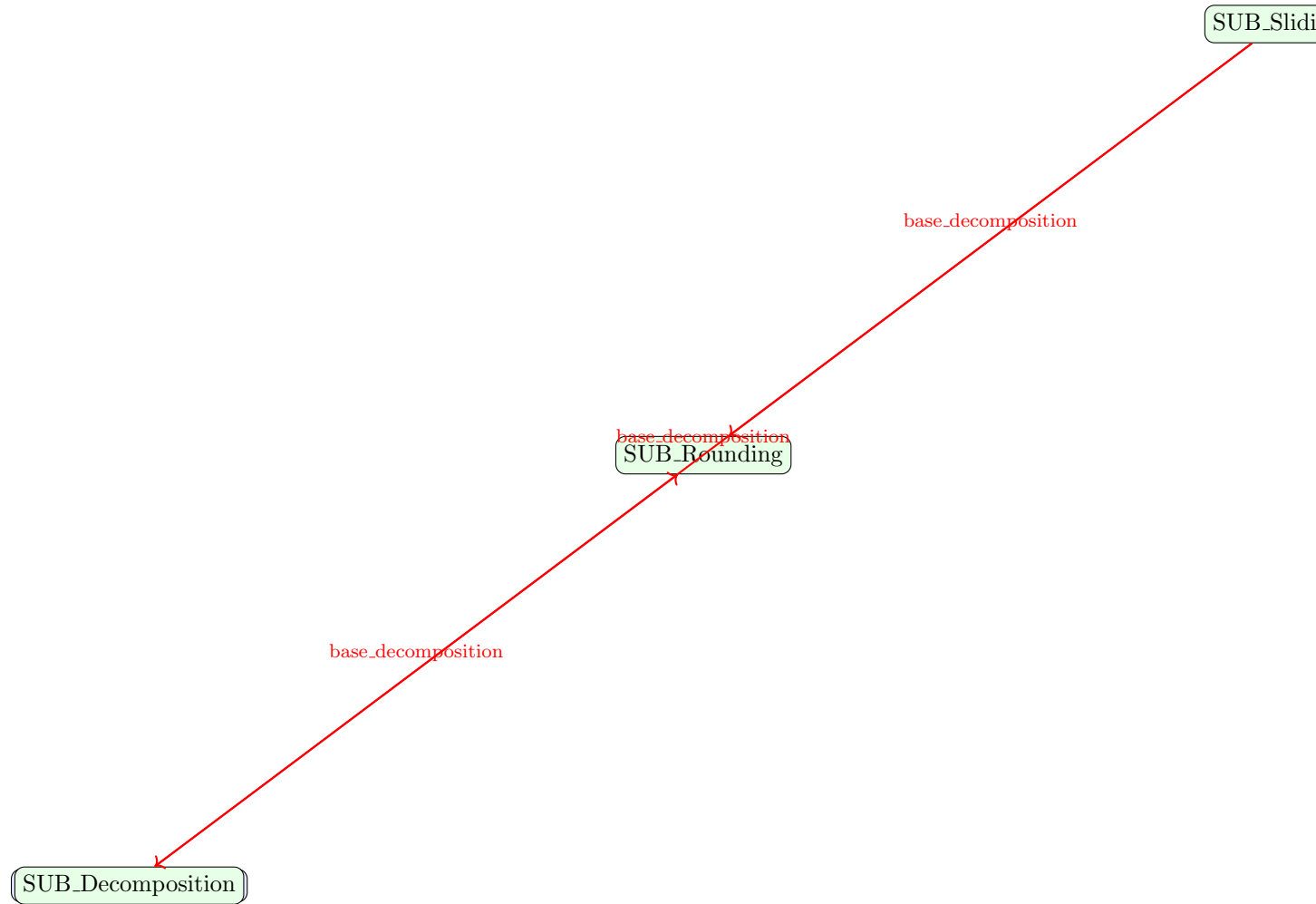
4.14   Subtraction

Operation: Subtraction
Strategies Analyzed: 3
Elaborations Detected: 3

SUB_Slidi

base_decomposition

base_decomposition
SUB_Rounding

base_decomposition

SUB_Decomposition

Summary:

```
Automated MUD Analysis for Subtraction
================================================================
Total strategies analyzed: 3
Total elaborations detected: 3

Key Patterns Identified:
  • base_decomposition: 3 relationships

Notable Elaborations:
  • SUB_Sliding → SUB_Decomposition
    Shared: base_decomposition (confidence: 1.00)
  • SUB_Sliding → SUB_Rounding
```
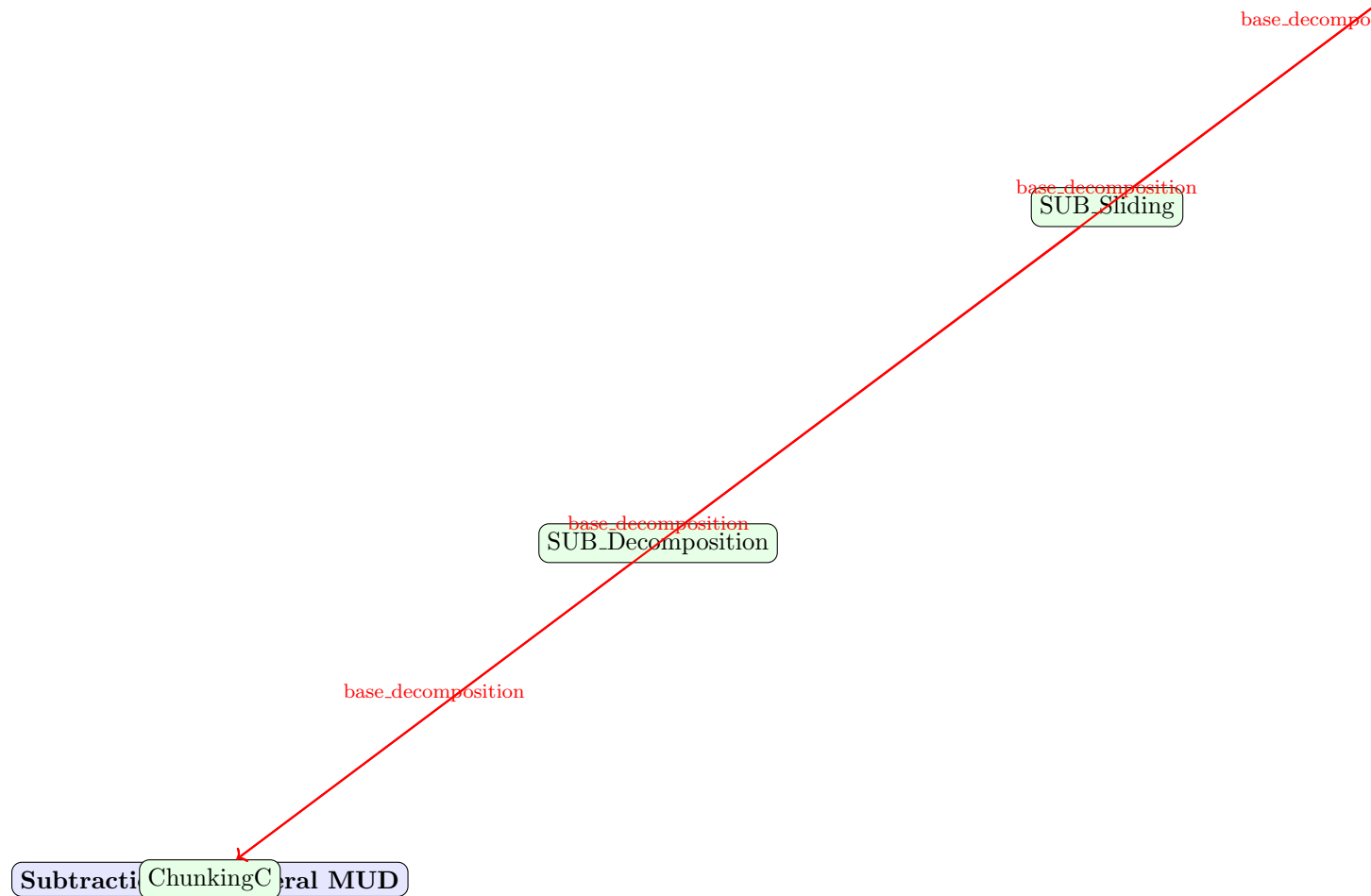
```
      Shared: base_decomposition (confidence: 1.00)
• SUB_Decomposition → SUB_Rounding
      Shared: base_decomposition (confidence: 1.00)
```

4.15 Subtraction To General

Operation: Subtraction To General
Strategies Analyzed: 4
Elaborations Detected: 4

base_decompo

base_decomposition
SUB_Sliding

base_decomposition
SUB_Decomposition

base_decomposition

Subtracti ChunkingC ral MUD

Summary:

```
Automated MUD Analysis for Subtraction To General
================================================================
Total strategies analyzed: 4
Total elaborations detected: 4

Key Patterns Identified:
  • base_decomposition: 4 relationships

Notable Elaborations:
```
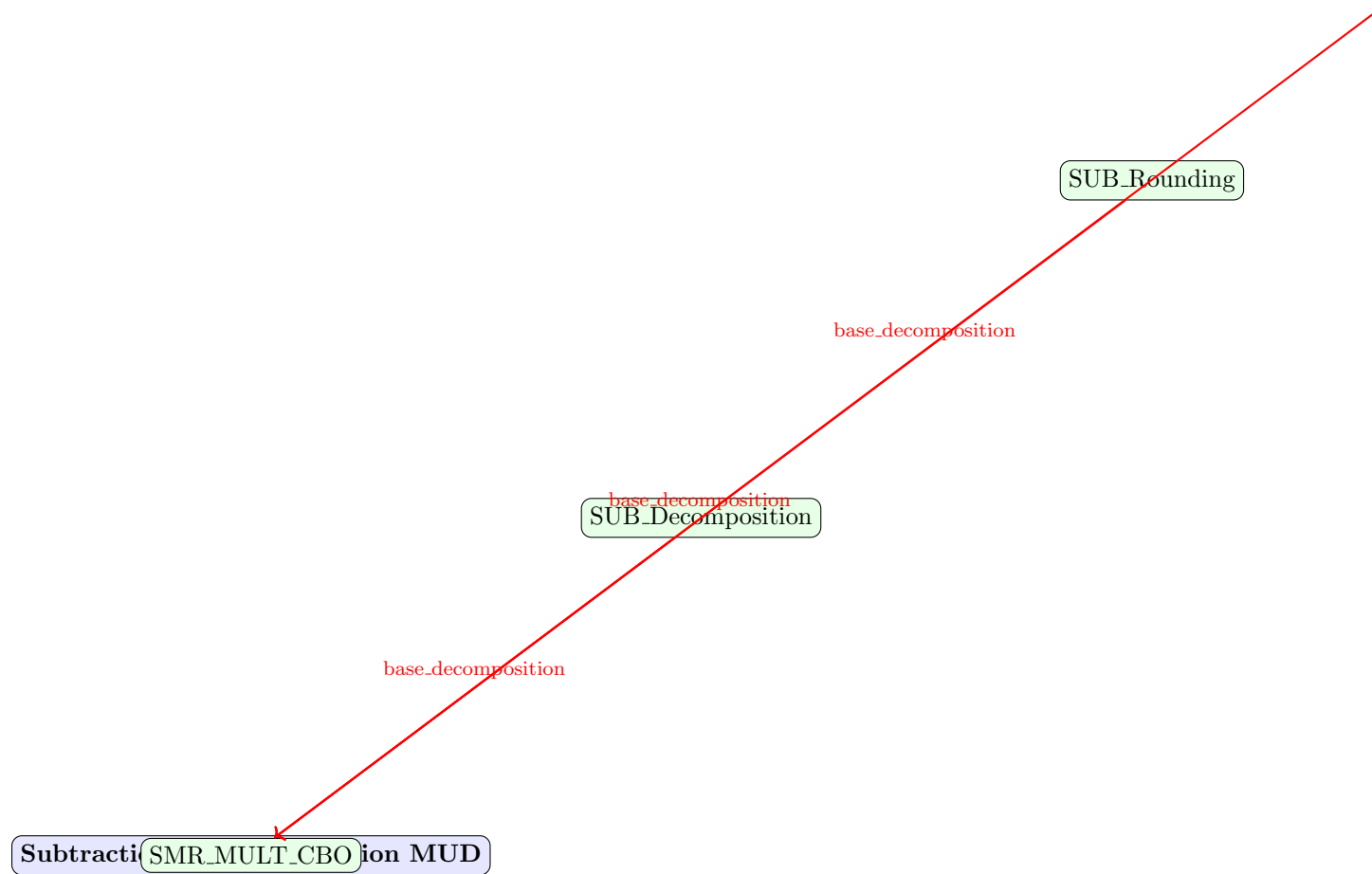
- SUB_Sliding → ChunkingC
  Shared: base_decomposition (confidence: 1.00)
- SUB_Sliding → ChunkingB
  Shared: base_decomposition (confidence: 1.00)
- SUB_Decomposition → ChunkingC
  Shared: base_decomposition (confidence: 1.00)
- SUB_Decomposition → ChunkingB
  Shared: base_decomposition (confidence: 1.00)

4.16   Subtraction To Multiplication

Operation: Subtraction To Multiplication
Strategies Analyzed: 4
Elaborations Detected: 3

SUB_Rounding

base_decomposition

base_decomposition
SUB_Decomposition

base_decomposition

Subtracti SMR_MULT_CBO ion MUD

Summary:

```
Automated MUD Analysis for Subtraction To Multiplication
================================================================
Total strategies analyzed: 4
Total elaborations detected: 3

Key Patterns Identified:
  • base_decomposition: 3 relationships

Notable Elaborations:
```

- SUB_Sliding → SMR_MULT_CBO
  Shared: base_decomposition (confidence: 1.00)
- SUB_Decomposition → SMR_MULT_CBO
  Shared: base_decomposition (confidence: 1.00)
- SUB_Rounding → SMR_MULT_CBO
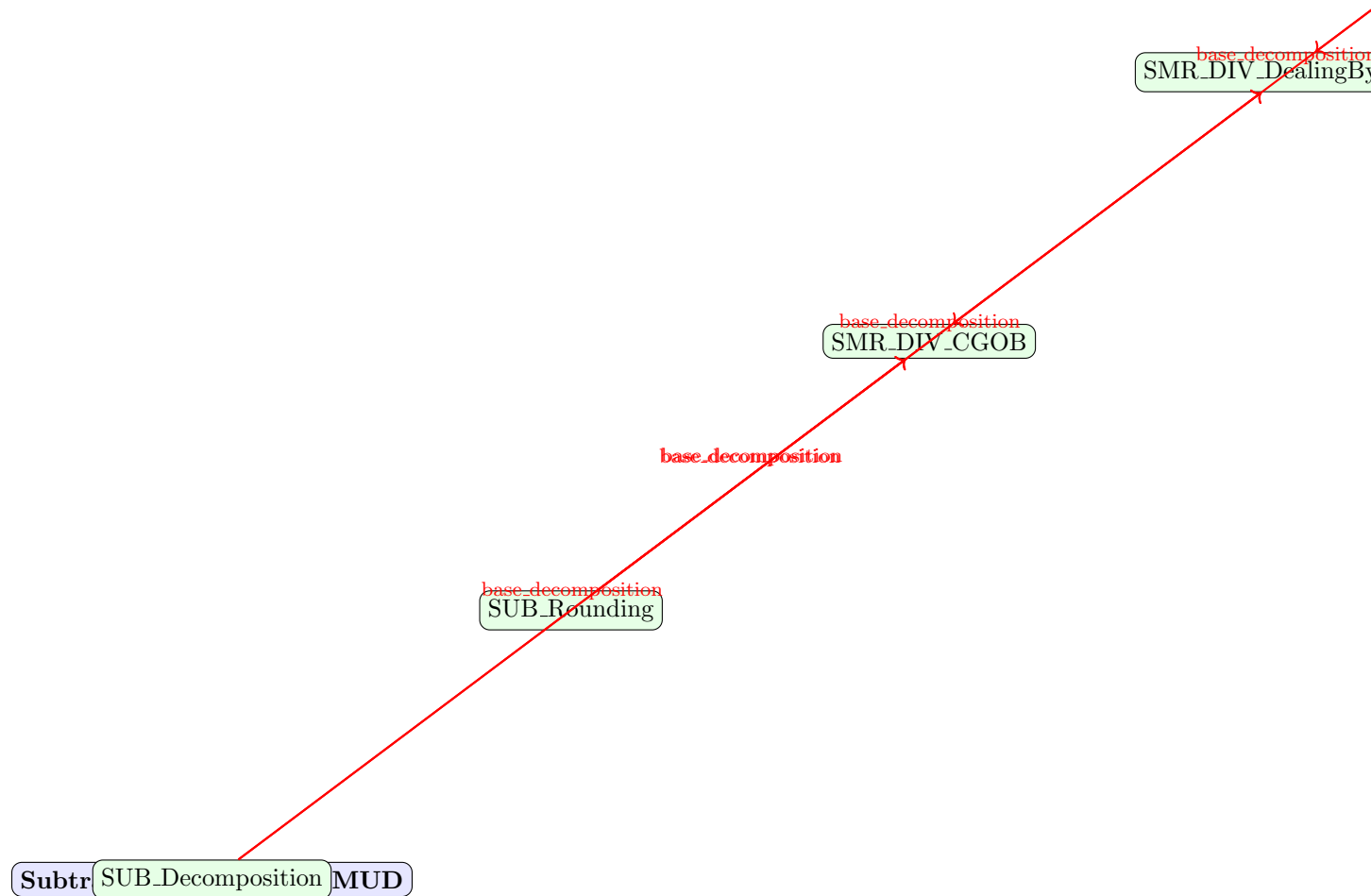 Shared: base_decomposition (confidence: 1.00)

4.17   Subtraction To Division

Operation: Subtraction To Division
Strategies Analyzed: 5
Elaborations Detected: 6

SMR_DIV_DealingBy

base_decomposition

SMR_DIV_CGOB

base_decomposition

base_decomposition

SUB_Rounding

base_decomposition

Subtr SUB_Decomposition MUD

Summary:

```
Automated MUD Analysis for Subtraction To Division
==============================================================
Total strategies analyzed: 5
Total elaborations detected: 6

Key Patterns Identified:
```
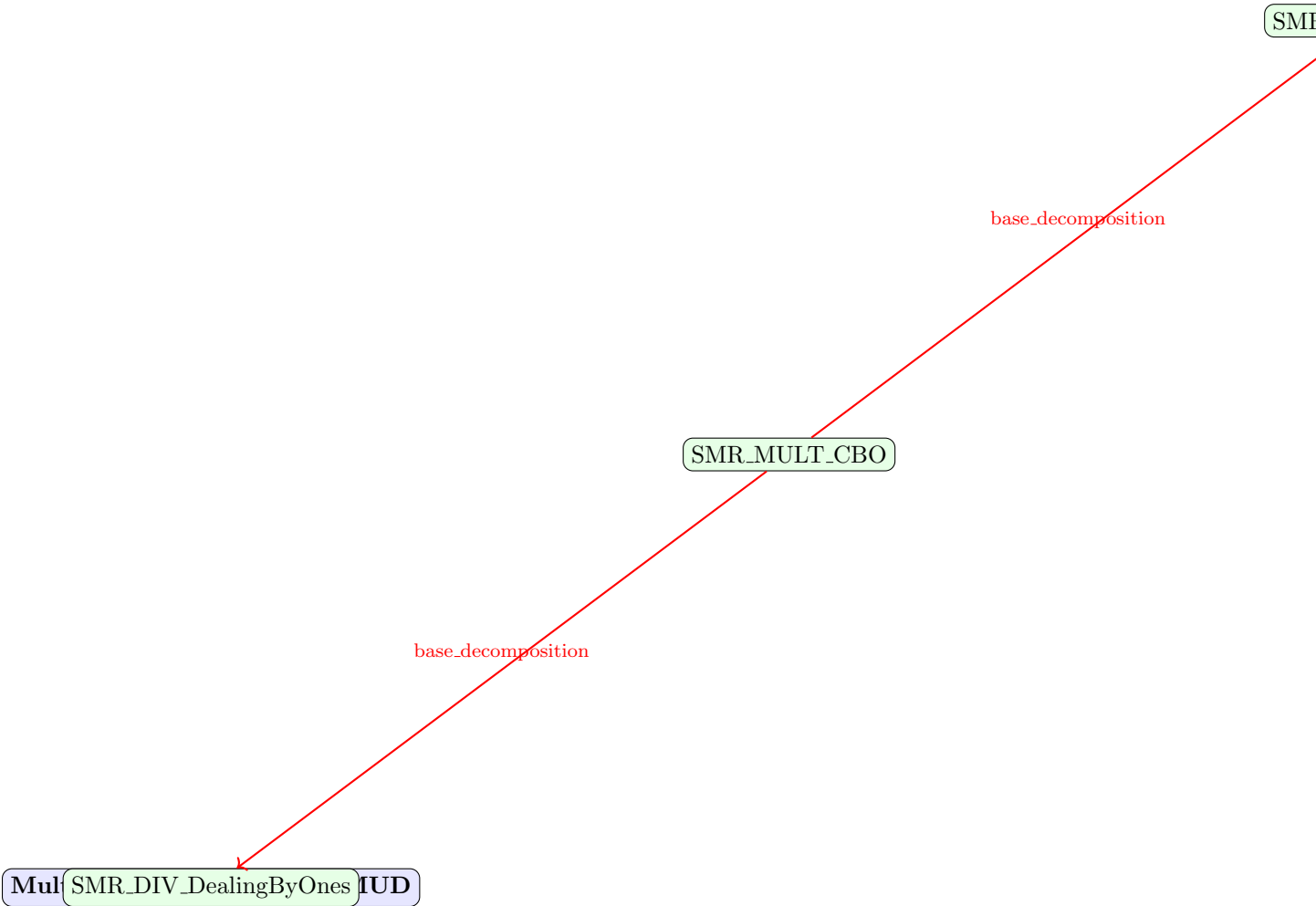
- base_decomposition: 6 relationships

Notable Elaborations:
- SUB_Sliding → SMR_DIV_CGOB
  Shared: base_decomposition (confidence: 1.00)
- SUB_Sliding → SMR_DIV_DealingByOnes
  Shared: base_decomposition (confidence: 1.00)
- SUB_Decomposition → SMR_DIV_CGOB
  Shared: base_decomposition (confidence: 1.00)
- SUB_Decomposition → SMR_DIV_DealingByOnes
  Shared: base_decomposition (confidence: 1.00)
- SUB_Rounding → SMR_DIV_CGOB
  Shared: base_decomposition (confidence: 1.00)
- ... and 1 more high-confidence relationships

4.18   Multiplication To Division

Operation: Multiplication To Division
Strategies Analyzed: 3
Elaborations Detected: 2

SME

base_decomposition

SMR_MULT_CBO

base_decomposition

Mul SMR_DIV_DealingByOnes IUD

Summary:

```
Automated MUD Analysis for Multiplication To Division
==============================================================
Total strategies analyzed: 3
Total elaborations detected: 2

Key Patterns Identified:
  • base_decomposition: 2 relationships

Notable Elaborations:
  • SMR_MULT_CBO → SMR_DIV_CGOB
    Shared: base_decomposition (confidence: 1.00)
  • SMR_MULT_CBO → SMR_DIV_DealingByOnes
    Shared: base_decomposition (confidence: 1.00)
```
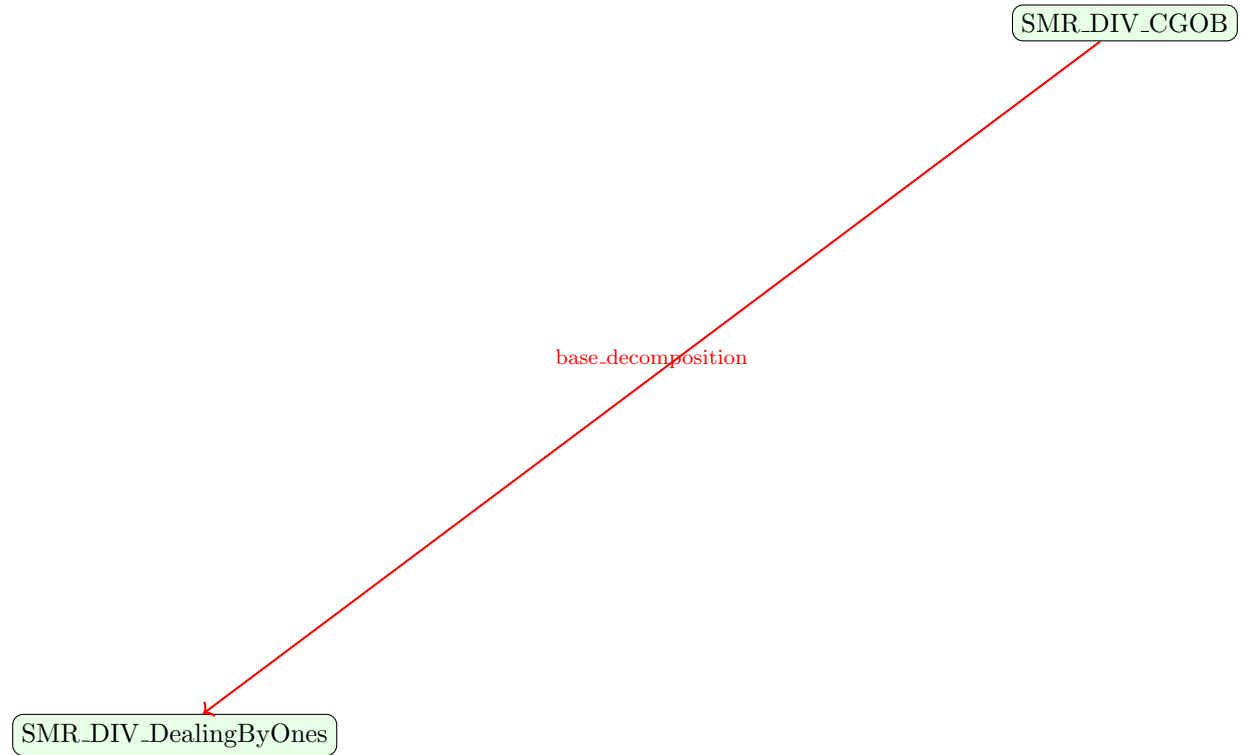
4.19   Division

Operation: Division
Strategies Analyzed: 2
Elaborations Detected: 1

SMR_DIV_CGOB

base_decomposition

SMR_DIV_DealingByOnes

Summary:

```
Automated MUD Analysis for Division
=============================================================
Total strategies analyzed: 2
Total elaborations detected: 1

Key Patterns Identified:
  • base_decomposition: 1 relationships

Notable Elaborations:
  • SMR_DIV_CGOB → SMR_DIV_DealingByOnes
    Shared: base_decomposition (confidence: 1.00)
```