Multi-Level Optimization: Overview of Basic Transforms

(taken from Giovanni De Micheli, “Synthesis and Optimization of Digital Circuits” (McGraw Hill), ch. 8.2)
Basic Representation #1: Logic Network

Fig. 8.3(a)

Basic Representation #2: Logic Network Graph

Fig. 8.3(b)
Comparison: Logic Network vs. Logic Network Graph

![Logic network and logic network graph with equations and nodes](image)

Multi-Level Optimization Example: Initial Design

![Multi-level optimization example with equations and nodes](image)
Transform #1: ELIMINATE (collapse)

Eliminate a node: “collapse” network structure

Fig. 8.3(a)
Transform #2: DECOMPOSE

Break 1 larger node into several smaller nodes

Fig. 8.3(a) before

Transform #2: DECOMPOSE

Break 1 larger node into several smaller nodes

Fig. 8.3(a) after
Transform #3: EXTRACTION

Create/extract “common subexpression” for 2 or more nodes

Fig. 8.3(a)

before

#11

Transform #3: EXTRACTION

Create/extract “common subexpression” for 2 or more nodes

after

#12
Transform #4: SIMPLIFICATION

Perform optimization (usually Boolean) within a single node

Fig. 8.3(a)

before

Transform #4: SIMPLIFICATION

Perform optimization (usually Boolean) within a single node

after
Transform #5: SUBSTITUTION

Find an existing “common subexpression” for 1 or more nodes

before

Transform #5: SUBSTITUTION

Find an existing “common subexpression” for 1 or more nodes

after