## Author

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## Classifying Behavior of the Process Parameter Variations

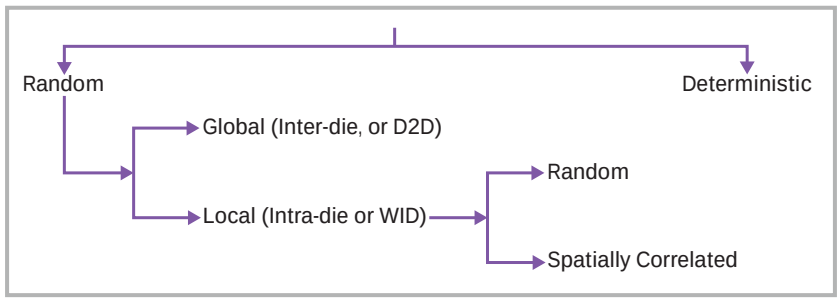


Figure 1: Independent and Correlated Process Parameter Variations in Silicon Photonics

Summarizing the above, process parameter variations in a parameter α can be modeled as:

$$\hat{o} < \hat{o}_0 * \hat{o}_{D2D} * \hat{o}_{WID,\ random} * \hat{o}_{WID,\ correlated}$$

where α  is the nominal value of the parameter α. Last three terms in the above expression represent die-to-die and

The mean and variance of α are:

Mean:

$$m_{\hat{o}} < \hat{o}_0$$

Variance:

$$\check{A}^2_{\hat{o}} < \check{A}^2_{\hat{o}C1C} * \check{A}^2_{\hat{o}V\sharp C\cdot\ random} * \check{A}^2_{\hat{o}V\sharp C\ \ correlated}$$

## Monte Carlo Process Variation and Corner Analyses in Synopsys OptoCompiler-OptSim

### Defining Parameters Using Statistical Expressions

Figure 2: Schematic of a 6-stage lattice filter (a). Each hierarchy comprises of three stages (b) where each stage is implemented as parametric custom photonic block (c)

Defining parameter G via a statistical expression, say, GAUSS(1µm,0.025µm) would imply that gap G follows a Gaussian distribution with 1µm mean and a 3σ deviation of 0.025µm relative to the mean. Process correlation can be specified via intermediate variable definitions. For example:

G1=GAUSS(0.1µm,0.025µm)

G_wafer_to_wafer = AGAUSS(0.0,0.01µm)

If G_wafer_to_wafer represents another random variable with zero mean and absolute 3σ deviation of 0.01µm, an expression like

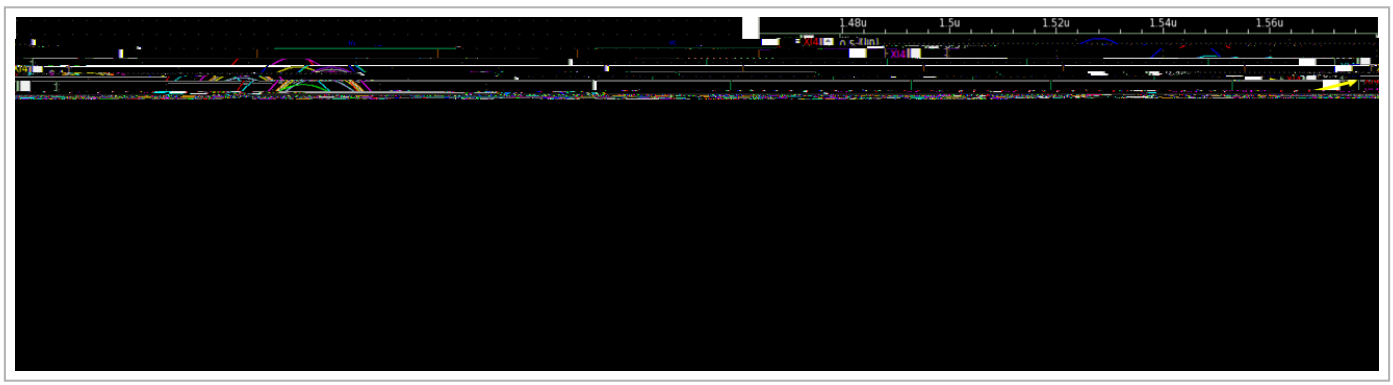


Figure 3: Filter response after 3- (upper right) and 6- (lower right) stages of lattice filters accounting for process parameter variations in gap and delay length

## Using Sub-Circuit Definitions

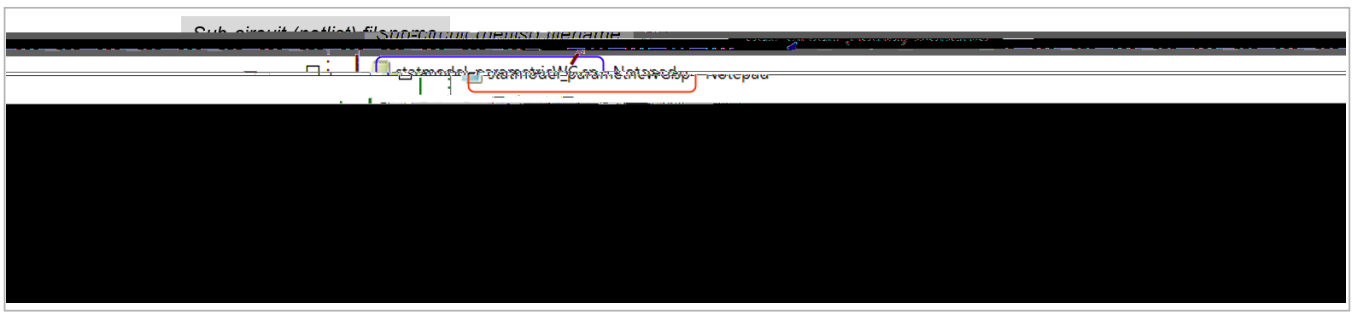

Figure 4: Example of a sub-circuit definition with process parameter variations

illustrated in Figure 5.

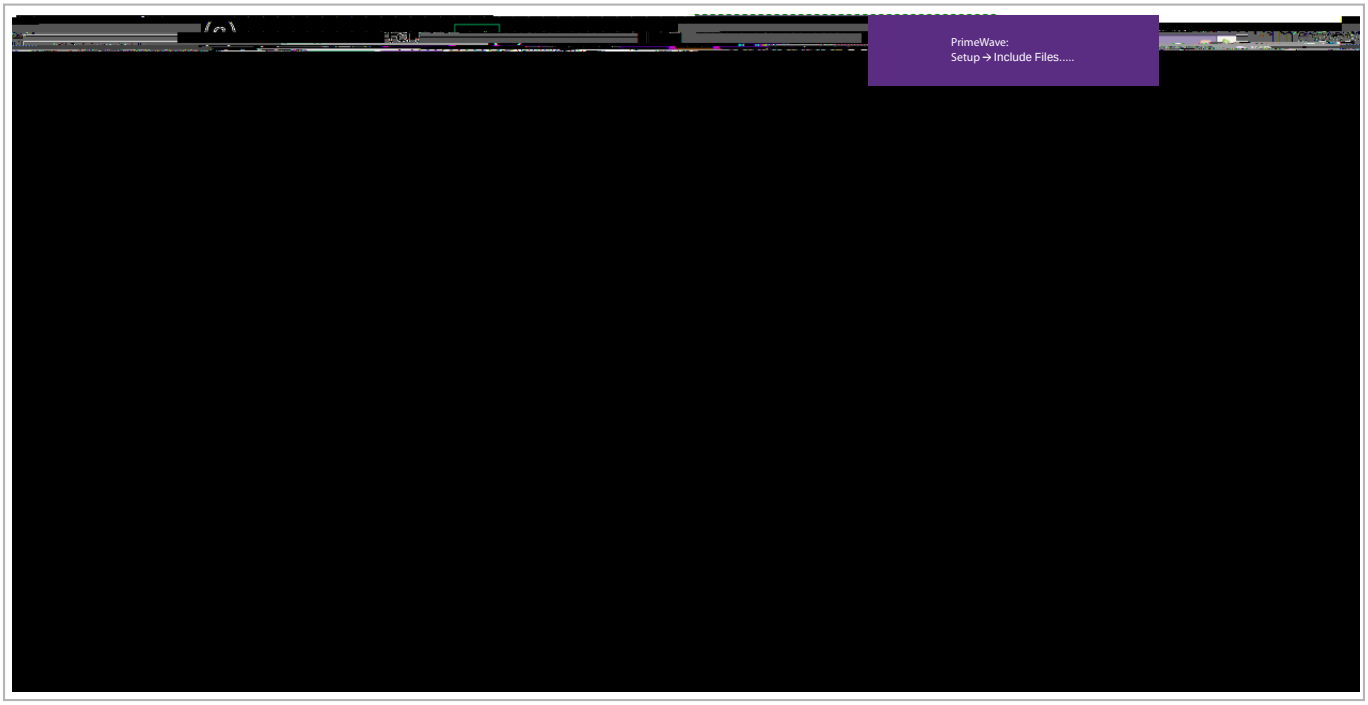


Figure 5: (a) A Mach-Zehnder Interferometer (MZI) comprising of two waveguide sub-circuits (b) including sub-circuit file of Figure 4 during run time and (c) MZI response due to process parameter variations