Digital Circuit Optimization via Geometric Programming

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Operations Research, 53(6): 899-932, 2005.

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Related material:

- A Tutorial on Geometric Programming

- Geometric Programming Applications to EDA Problems (DATE 2005 tutorial)

- A Heuristic for Optimizing Stochastic Activity Networks with Applications to Statistical Digital Circuit Sizing

- GGPLAB, a simple Matlab toolbox for geometric programming

This tutorial paper concerns a method for digital circuit sizing based on formulating the problem as a geometric program (GP), a special type of mathematical optimization problem that can be very efficiently solved. We start with a basic gate scaling problem, with delay modeled as a simple RC time constant, and then add various layers of complexity and modeling accuracy, such as accounting for differing fall and rise times, effects of signal transition times, and so on. We then consider more complex formulations such as design over corners, multi-scenario design, and statistical design. Finally, we consider problems in which threshold and power supply voltage are also variables to be chosen. In all cases our focus is on formulating the problem as a GP, or an extension of GP called generalized geometric programming (GGP).

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