Outline

❏ Digital CMOS Design

❏ Arithmetic Operators

❏ Floating Point Arithmetic Operators

  ◗ Square root
  ◗ division

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Square root

o Direct method ➡ digit-by-digit

o Indirect method ➡ resolve a non-linear equation

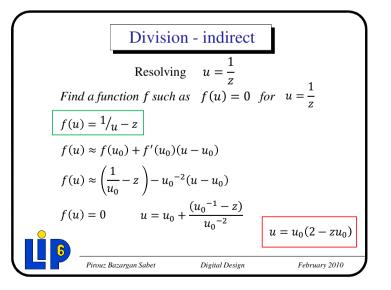*Pirouz Bazargan Sabet*   *Digital Design*   *February 2010*

Division

Two real number y and z using floating point representation

Find a real number x such as

$$x + \varepsilon = \frac{y}{z}$$

o Calculation cannot be implemented in hardware

o Need iterative operation

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Division - indirect

Resolving $u = \dfrac{1}{z}$

Find a function f such as $f(u) = 0$ *for* $u = \dfrac{1}{z}$

$f(u) = {}^1\!/u - z$

$f(u) \approx f(u_0) + f'(u_0)(u - u_0)$

$f(u) \approx \left(\dfrac{1}{u_0} - z \right) - u_0^{-2}(u - u_0)$

$f(u) = 0 \qquad u = u_0 + \dfrac{(u_0^{-1} - z)}{u_0^{-2}}$

$u = u_0(2 - zu_0)$

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Division - indirect

Resolving $\quad u = \dfrac{1}{z}$

Each iteration $\quad u_{i+1} = u_i(2 - zu_i)$

multiply !!

$u = \dfrac{1}{z}$ $\qquad$ $x = \dfrac{y}{z} = u \cdot y$

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