2ⁿᵈ order type 1 Phase-locked loop
Slave with frequency controlled VCO

Error signal
$E(s) = X(s) - Y(s)]$

$G_f/(s\tau_f + 1)$
G_f for a 1ˢᵗ order loop

G_{VCO}/s

Incoming signal X(s)

Phase Comparator G_φ

$G_\varphi E(s)$

Low pass Filter (single pole)

Frequency correction

Local clock

Local clock Y(s)

Clock for Data Recovery Y(s)
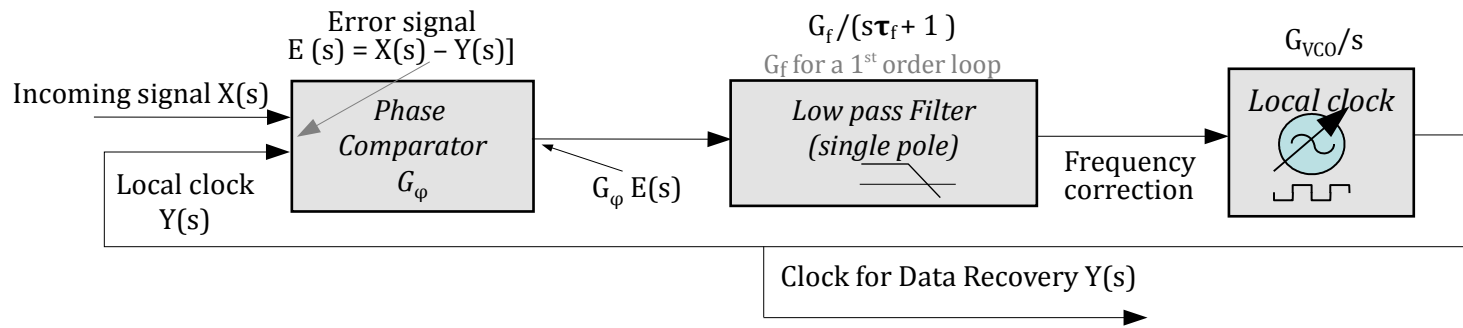
2nd order type 1 Phase-locked loop
Slave with integrator and delay line

Error signal
$E(s) = X(s) - Y(s)]$

$1/(s\tau_f + 1)$

G_f/s

G_{VCO}

Incoming signal X(s)

Phase Comparator G_φ

$G_\varphi E(s)$

Low pass Filter (single pole)

Frequency correction

Integrator G_f

Phase correction

Local clock

Local clock Y(s)

Clock for Data Recovery Y(s)

Data for Data Recovery

Clock for Data Recovery Φ
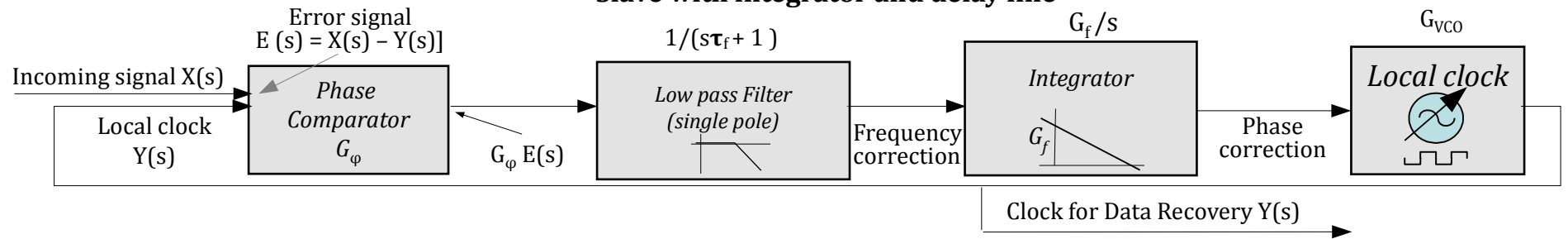
2nd order (type 1) Phase-locked loop
Phase Aligner

Φ = 0 *Local clock*

Error signal
$E(s) = X(s) - Y(s)]$

$1/(s\tau_f + 1)$

G_f/s

Incoming signal X(s)

+

Phase Adder $G_+ = 1$

+

$W(s) = -Y(s)$

$G_+(X(s) - Y(s))$

-

+

Phase Comparator G_φ

$G_\varphi(X(s) - Y(s))$

Low pass Filter (single pole)

Integrator G_f

Phase Addition
$W(s) = -Y(s)$