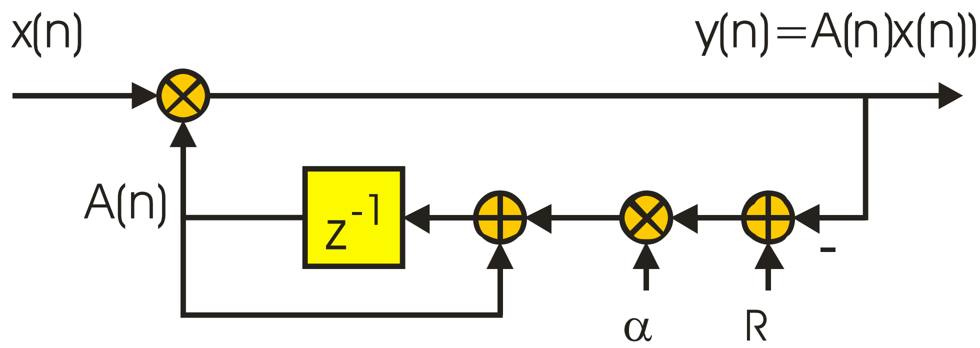
AGC

fred harris

UCSD

Automatic Gain Control (1)



$$y(n) = A(n)\,x(n)$$
$$A(n+1) = A(n) + \alpha\,[R - y(n)]$$
$$A(n+1) = A(n) + \alpha\,[R - A(n)\,x(n)]$$
$$A(n+1) = A(n)[1 - \alpha\; x(n)] + \alpha\; R$$

Suppose $x(n) = c\,u(n)$, $c =$ constant

then

$$A(n+1) = A(n)[1 - \alpha\; c] + \alpha\; R$$

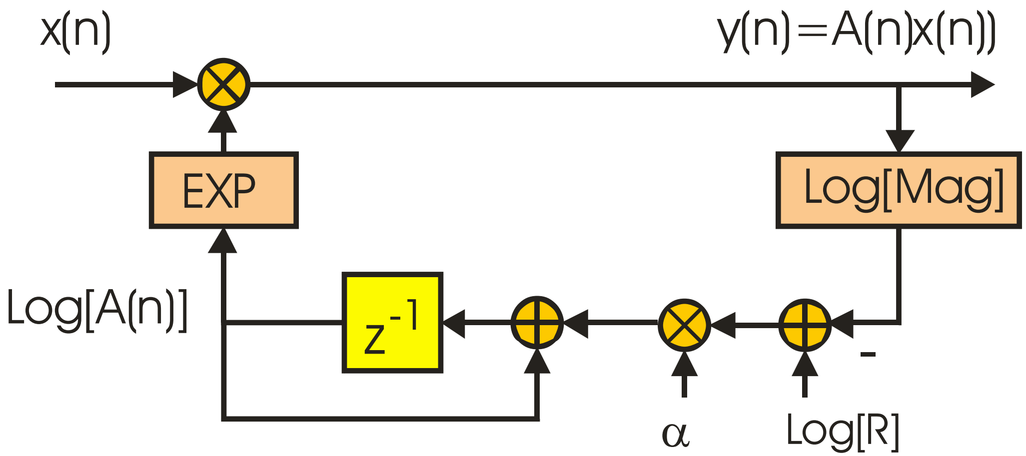
note that $\alpha\, c < 2.0$.

Steady state of this system is $1/c$ so that the steady state gain $A(\infty)$ is R/c and the steady state output $y(\infty)$ is $c\,R/c$ or R. The steady state output level equals the desired reference level R.

The time constant is $1/\alpha\, c$ samples.

If c is small, long transient. If c is large, short transient

Automatic Gain Control (2)



$$y(n) = A(n)\,x(n)$$

$$Log[A(n+1)] = Log[A(n)] + \alpha\{[Log[R] - Log[y(n)]\}$$

$$Log[A(n+1)] = Log[A(n)] + \alpha\{Log[R] - Log[A(n)\,x(n)]\}$$

$$Log[A(n+1)] = Log[A(n)][1-\alpha] - \alpha\ Log[x(n)/R]$$

Suppose $x(n) = c\,u(n)$, $c =$ constant

then

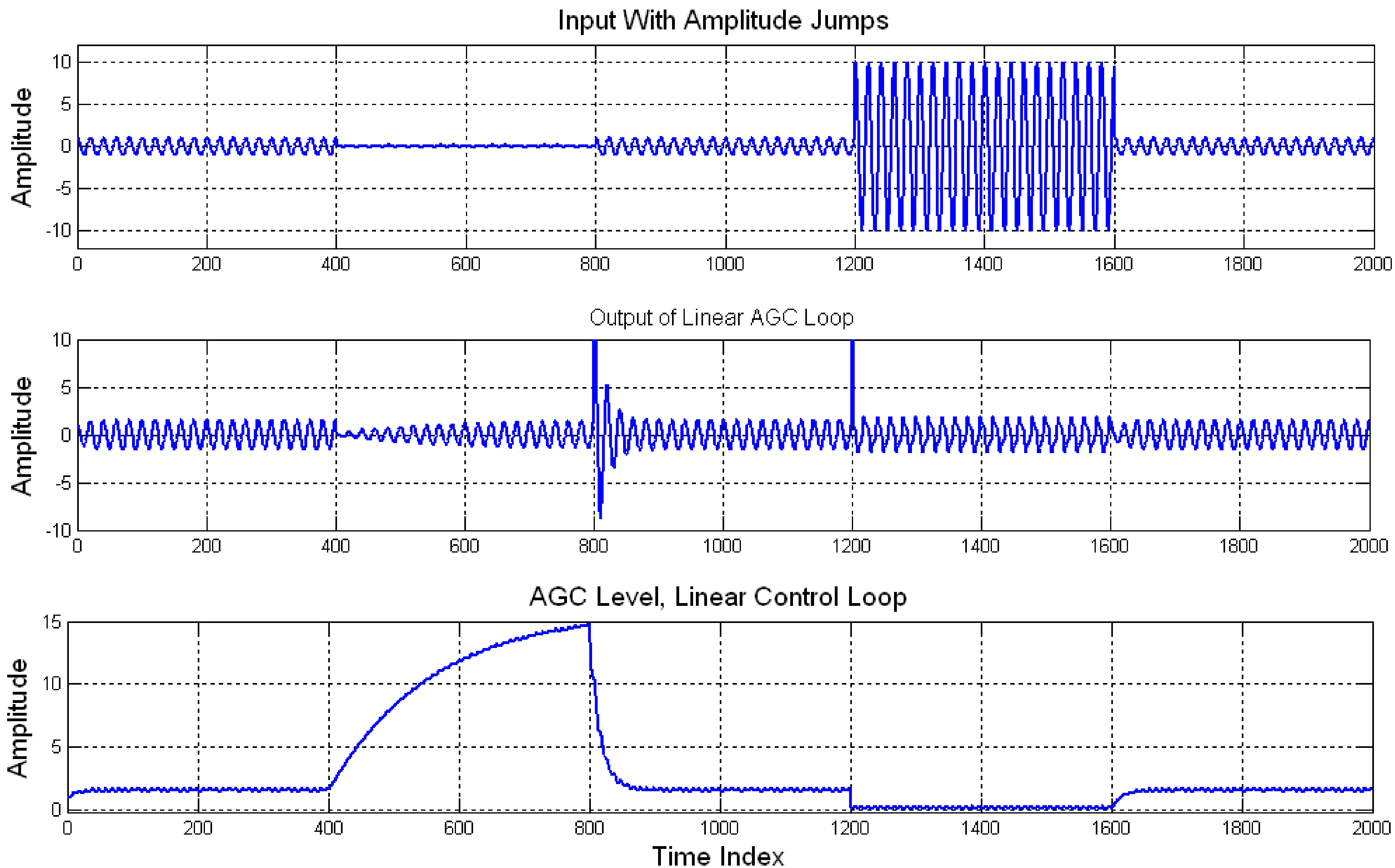
$$Log[A(n+1)] = Log[A(n)][1-\alpha] - \alpha\ Log[c/R]$$

note that $\alpha < 2.0$.

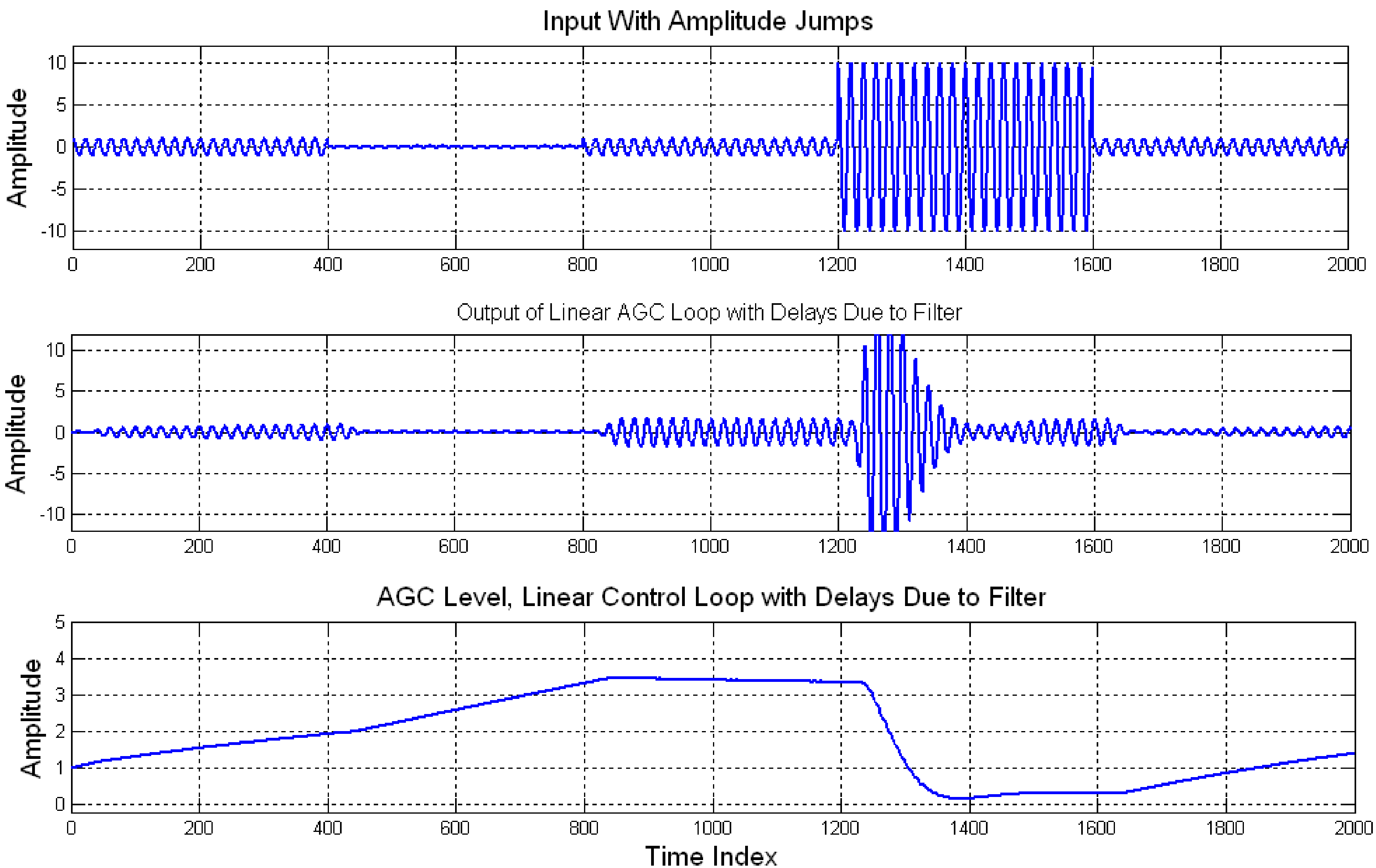
Steady state of this system is $1/c$ so that the steady state gain $A(\infty)$ is R/c and the steady state output $y(\infty)$ is $c\ R/c$ or R.

The steady state output level equals the desired reference level R. The time constant is $1/\alpha$ samples, and is independent of input amplitude.

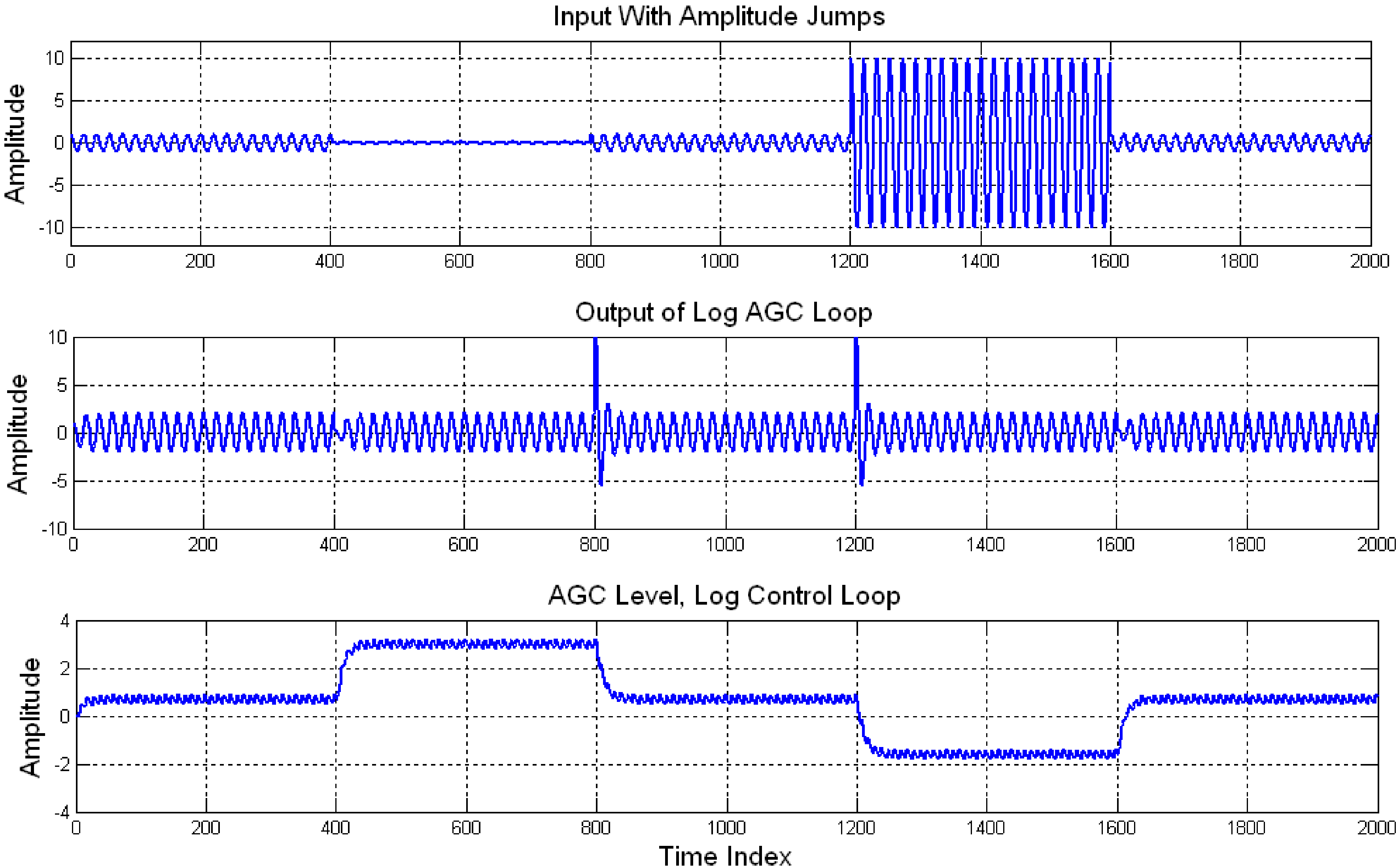
Linear Loop AGC Responses



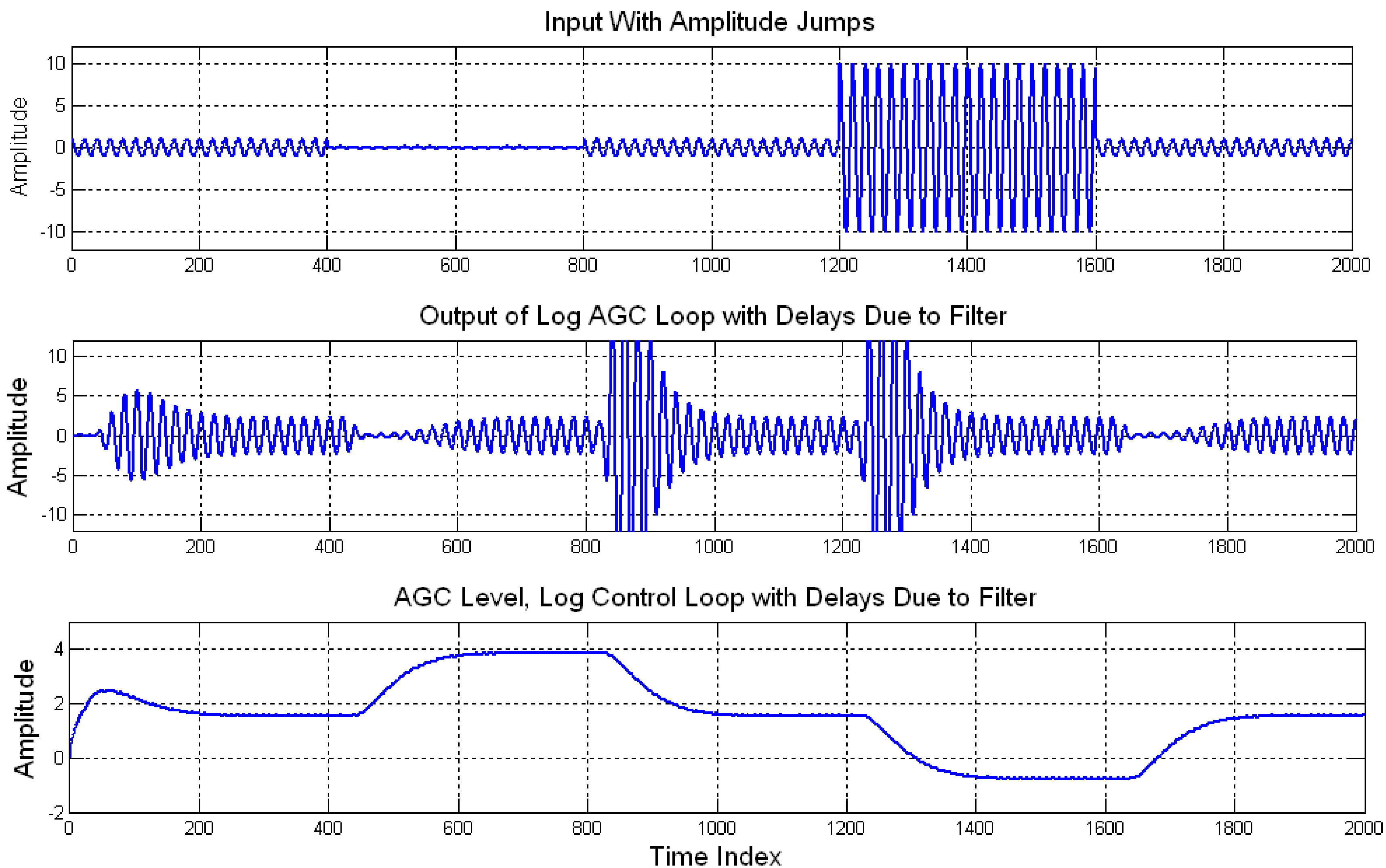
Linear Loop AGC Responses: with Filter Delays



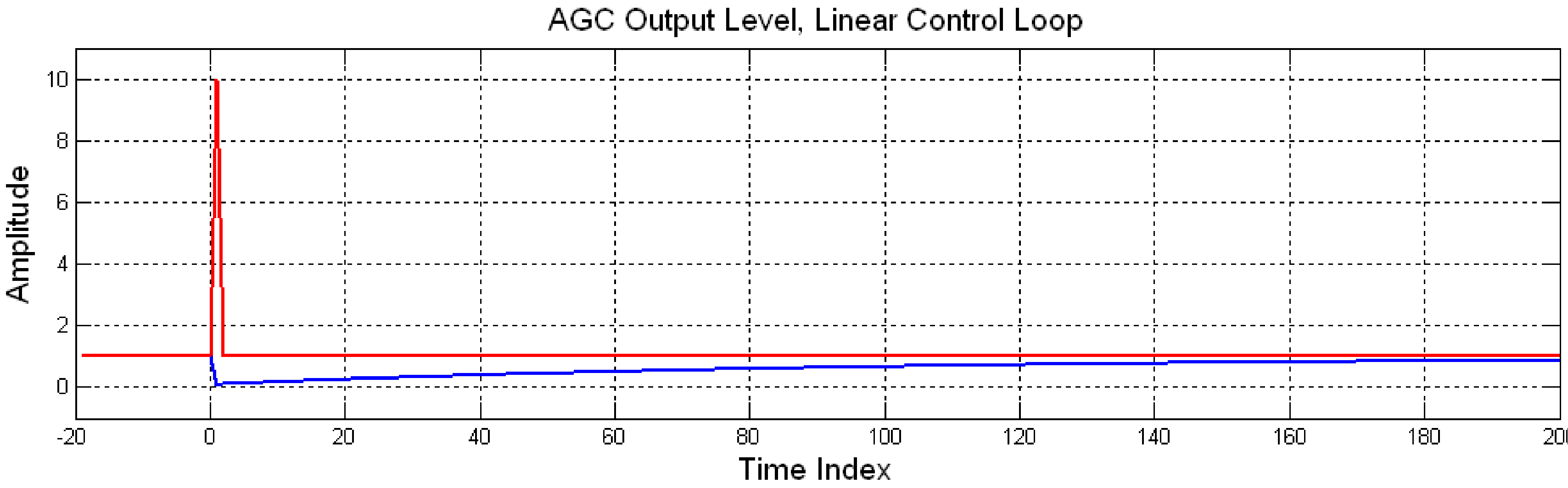
Log Loop AGC Responses

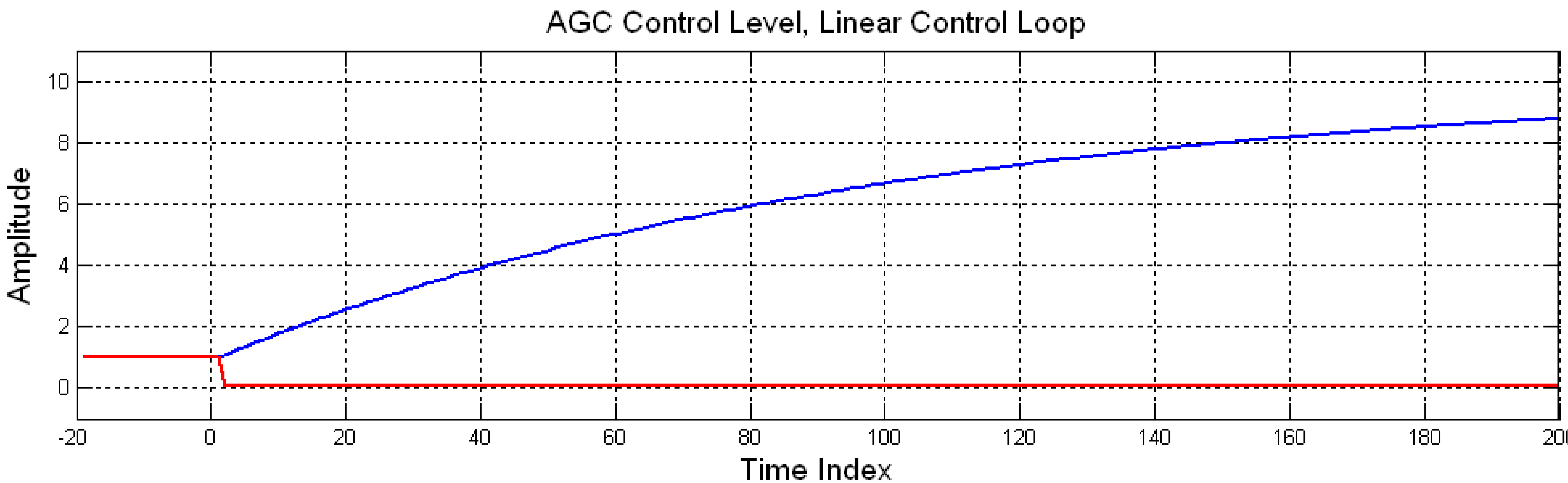


Log Loop AGC Responses: with Filter Delays



Linear Loop AGC Output and Control Levels





Log Loop AGC Output and Control Levels