LETTER TO THE EDITOR

Comments on "Fractionally Spaced Equalization: An Improved Digital Transversal Equalizer," by R. D. Gitlin and S. R. Weinstein*

(Communication received November 1981)

In the Gitlin and Weinstein paper, Fig. 3 and Formula (15) give the following result: the equalized signal, called $\tilde{u}(t)$, is analytic, i.e., its real and imaginary parts are a Hilbert transform pair. This result is contradictory with the fact that in *QAM*, $\mathrm{Re}\{\tilde{u}(t)\}$ contains in-phase data a_n, and $\mathrm{Im}\{\tilde{u}(t)\}$ contains independent quadrature data b_n. It is worthwhile to make the three following points:

(*i*) $\tilde{q}(t)$ in Formula (13), is not analytic since ω_c is within the band of $s(t)$. Therefore, $\tilde{q}(t)$ cannot be written as $q(t) + j\check{q}(t)$ as it was done on page 281. Consequently, $\tilde{u}(t)$ is complex but not analytic and its real and imaginary parts are not Hilbert transform. $\tilde{q}(t)$ and $\tilde{u}(t)$ are analytic if ω_c is on the edges of the band of $s(t)$ or outside this band as is the case in single sideband systems.

(*ii*) In Formula (9), $\tilde{s}(t)$ is analytic if and only if $P(\omega) = 0$; $|\omega| \geq \omega_c$.

(*iii*) On page 280, it should be noted that $\tilde{f}_B(t)$ should be given by the convolution of $\frac{1}{2}\tilde{x}_B(t)e^{-j\theta}$ with $p(t)$, where $\theta = \measuredangle X(\omega_c)$. The factor $\frac{1}{2}$ was indeed mentioned in the Appendix, Formula (62).

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Author Response

Mr. Kawas-Kaleh is correct in pointing out that $\tilde{q}(t)$ is not an analytic signal. Since $\tilde{r}(t) = r(t) + j\check{r}(t)$ is an analytic signal centered about w_c, the demodulated signal $\tilde{q}(t)$ will be a complex signal having frequency components centered about the origin, and hence cannot be an analytical signal.

The condition that $P(w) = 0$ when $|w| \geq w_c$, which is implied though not explicitly stated in the paper, is standard practice.

It should be noted that Mr. Kawas-Kaleh's comments concerning analytic signals in no way affect the performance attributes of the fractionally spaced equalizer reported in the paper.

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