Comments on "A Note on the Predictability of Band-Limited Processes"

by Farokh Marvasti

Abstract

We show that the problem presented in the above letter [papoulis1985] by Papoulis has been proved by others [beutler1966, fjallbrandt1975, requicha1980, knab1981] using different methods. We present a much simpler proof which covers random and deterministic signals with uniform or nonuniform sampling

I just came across a recent letter by Papoulis [papoulis1985] on past uniform sampling of random signals. This problem was solved in [wainstein1962] at three times the Nyquist rate and in [brown1972] at two times the Nyquist rate. Beutler [beutler1966] solved this problem both for deterministic and random signals for general nonuniform samples at any rate greater than that of Nyquist. Fjallbrandt [fjallbrandt1975] has verified [beutler1966] for past uniform samples. Although the proof by Papoulis [papoulis1985] is different from the others, there is a much simpler way to prove past sampling for uniform or nonuniform samples for deterministic or random signals. The proof is implied in [requicha1980].

Proof. If the past samples have a rate slightly greater than the Nyquist, then no band-limited signal (having a bandwidth equal to or smaller than half the Nyquist rate) can be found to have zero crossings at the past instances. This is because the average zero crossings per interval of a band-limited signal is equal to the Nyquist rate. Therefore, the past samples represent uniquely the band-limited signal [requicha1980]. This argument is valid for deterministic and random signals with uniform (or random) samples. □

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Bibliography

[wainstein1962] L. A. Wainstein and V. D. Zubakov, *Extraction of Signals from Noise*. Englewood Cliffs, NJ: Prentice-Hall, 1962.

[brown1972] J. L. Brown, Jr., "Uniform linear prediction of bandlimited processes from samples," *IEEE Trans. Inform. Theory*, vol. IT-18, pp. 662-664, Sept. 1972.

[beutler1966] F. Beutler, "Error free recovery of signals from irregular samples," *SIAM Rev.*, vol. 8, pp. 322-335, July 1966.

[fjallbrandt1975] T. T. Fjallbrandt, "Interpolation and extrapolation in non-uniform sampling sequences with average sampling rate below the Nyquist rate," *Electron. Lett.*, vol. 11, no. 12, pp. 264-266, 12th June 1975.

[requicha1980] A. Requicha, "The zeros of entire functions: Theory and engineering applications," *Proc. IEEE*, vol. 68, no. 3, pp. 308-328, Mar. 1980.

[knab1981] J. J. Knab, "Noncentral interpolation of band-limited signals," *IEEE Trans. Aerosp. Electron. Syst.*, vol. AES-17, no. 4, pp. 586-590, July 1981.

[papoulis1985] A. Papoulis, "A Note on the Predictability of Band-Limited Processes," *Proc. IEEE*, vol. 73, no. 8, pp. 1332-1333, Aug. 1985.