Anytime Coding for Non-Stationary Channels: an Exploration

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Abstract

In this note, the authors provide an expression for an f-general error exponent upper bound in terms of the Gallager random coding exponent for the coherent durations of a time-varying additive white gaussian noise channel.

Definition 1. We define an f-general exponent as

$$\frac{\log f(Poe)}{\tau}. \tag{1}$$

Here Poe is the probability of decoding error and τ is the decoding duration.

In formula (1) if we set

$$f(x) = \frac{1}{x}, \tag{2}$$

we recover the usual error exponent [1, 2]. Using Definition 1, we state below a theorem without proof:

Theorem 2. *For an arbitrarily varying channel, the anytime [3] f-general exponent is upper bounded by*

$$\kappa \cdot \sum_{i=1}^{M} E^{i}_{orth}(R) \tag{3}$$

where κ is the ratio of the coherent duration of the channel to the normalized decoding duration and $E^{i}_{orth}(R)$ is the Gallager random coding exponent for the i-th coherent duration of the channel, R being the data transmission rate. Here the function $f(\cdot)$ is specified as

$$f(x) = \left[\frac{-\log(-\log(x))}{M}\right]^{M^2} \tag{4}$$

where M is the number of coherent periods that a single anytime code duration is divided into. The channel is assumed to be "fixed" during each coherent period. From period to period, the power constraint takes on different values, thereby changing the capacity and reliability function.

References

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