# On the Analysis of Heart Rate Variability in Frequency Domain

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**Abstract:** we define the basic foundations of a method for frequency domain analysis of time series biosignals of physiological and psycho-physiological interest in medicine and biology.

In analysis of heart rate we have the problem of its estimation in frequency domain. We are interested to the Power Spectrum of series $R(t)$ in the interval 0-0.5 Hz where the interval 0.003-0.04 Hz relates the so called VLF band, the interval 0.04-0.15 Hz is the LF band, and 0.15-0.4 Hz is the HF band.

In HRV analysis, given the time series $R(t)$ of R-R intervals. We may write its Power Spectrum as

$P(f) = Cf^{-(2H-1)}$ for stationary series.

Here $H$ is the Hurst exponent .

We perform now integration in the 0-0.5 Hz interval.

$$\int_0^{0.5} P(f)\,df = \int_0^{0.5} Cf^{-(2H-1)}df = \frac{C}{2-2H} f^{2-2H} \Big|_0^{0.5} = \frac{C}{2-2H}(0.5^{2-2H})$$

We know as to have $P(f)$ experimental determination and we call it $P_{\exp}(f)$. Consequently we have

$$P_{\exp}(f) = \frac{C}{2-2H}(0.5^{2-2H})$$

Therefore , we have

$$C_{estimated} = \frac{(2-2H)P_{\exp}(f)}{0.5^{2-2H}}$$

that may be inserted in

$$P(f) = C_{estimated} f^{-(2H-1)}$$

and, estimated $H$ by a proper method , we have the final evaluation of $P(f)$ . We have the value of the Total Spectrum as well as in the VLF, LF and HF bands.

The method may be also considered in more general time series of physiological and psycho-physiological interest in medicine and biology.