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Some results and problems in dyadic analysis: an overview

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Outline

(I) Notations.
(II) The known concepts of dyadic derivatives and integrals.
(III) Modified strong dyadic integral and derivative of fractional order on $f \in L^2[0,1)$.
(IV) Uniform integral in dyadic Hardy spaces.
(V) Dyadic analogue of Tauberian theorem of Wiener and related topics.
(VI) Dyadic Hardy and Hardy-Littlewood operators in the spaces $H_d(R_+)$ and $BMO_d(R_+)$.
(VII) Some problems.

1. Notations

Let us introduce some notations. For the number $x \in R_+ = [0, +\infty)$, we will use dyadic expansion $x = \sum\limits_{n=-\infty}^{+\infty} 2^{-n-1} x_n$ of x, where x_n be equal to 0 or 1. It is evident, that x_{-n} for $n \geq n(x)$. If x is dyadic rational, then we use finite expansion, i.e. $x_n = 0$ for $n \geq n(x)$.
Let us introduce the generalized Walsh functions

$$\psi(x,y) \equiv \psi_y(x) = (-1)^{t(x,y)},$$

where

$$t(x,y) = \sum_{n=-\infty}^{\infty} x_n \, y_{-n-1} \text{ for } (x,y) \in R_+ \times R_+.$$

It is evident that

$$\psi_y(x) = \psi_x(y), \ \psi_y(x) = \pm 1 \text{ for } x, y \in R_+.$$

Let us note that

$$w_n(x) \equiv \psi_n(x) \equiv \psi(x,n), \ n \in \mathbb{Z}_+, \ x \in R_+$$

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