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Gabor time-frequency lattices and the Wexler-Raz identity. (English) Zbl 0888.47018

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Summary: Gabor time-frequency lattices are sets of functions of the form $g_{m\alpha,n\beta}(t) = e^{-2\pi i\alpha mt}g(t-n\beta)$ generated from a given function $g(t)$ by discrete translations in time and frequency. They are potential tools for the decomposition and handling of signals that, like speech or music, seem over short intervals to have well-defined frequencies that, however, change with time. It was recently observed that the behavior of a lattice $(m\alpha, n\beta)$ can be connected to that of a dual lattice $(m/\beta, n/\alpha)$. Here we establish this interesting relationship and study its properties. We then clarify the results of applying the theory of von Neumann algebras. One outcome is a simple proof that for $g_{m\alpha,n\beta}$ to span L^2, the lattice $(m\alpha, n\beta)$ must have at least unit density. Finally, we exploit the connection between the two lattices to construct expansions having improved convergence and localization properties.

MSC:

47C15 Linear operators in C^*- or von Neumann algebras
94A11 Application of orthogonal and other special functions
46L05 General theory of C^*-algebras

Keywords:

Gabor time-frequency lattices; decomposition and handling of signals; von Neumann algebras; convergence; localization properties

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