Dedication

To my dear lovely parents and husband..

Acknowledgements

My gratitude to my supervisor Prof. Shawgy Hussein Abdalla for this ingenious advice and hard efforts Special thanks are extended to Sudan University of Science & Technology for giving me this chance for higher studies. Lastly my heart is full of thanks to my brother and sisters whom helped in preparing this project and all to dear friends for their help.

ABSTRACT

We show the sparse complete Gabor frame with systems over irregular lattices .The pairs of dual Gabor frame generated by compact support , desired frequency localization and polynomials are considered . Similarly we consider the Gabor windows supported on a closed interval and compactly supported dual windows with applied and computational harmonic analysis . We study the compactness of time – frequency analysis of localization operators on Hilbert space , partitions for the Gelfand triple and characterizations of modulation spaces with localization operators. We determine the Beurling density and shift-invariant weighted irregular Gabor systems , tight frames and dual systems using windows in the Schwartz class .

الخلاصة

أوضحنا اطار جابور التام المتناثر مع الانظمة فوق الشبكات غير المنتظمة . تم اعتبار ازواج اطار جابور الثنائي المولدة بواسطة دعامة التراص وموضع التردد المرغوب وكثيرات الحدود . بالمثل اعتبرنا نوافذ جابور المدعومة علي الفتره المغلقة . والنوافذ ثنائية الدعامة المتراصة مع التطبيق والتحليل التوافقي الحوسبي . درسنا التراص لتحليل تردد الزمن لمؤثرات الموضعية علي فضاء هلبرت والتجزئة لاجل ثلاثي جيلفاند والتشخيصات للفضاءات المعدلة مع المؤثرات الموضعية . حددنا كثافة بيرلنق وانظمة جابور غير المنتظمة المرجحة الازاحة – غير المتغيرة والاطارات الضيقة والانظمة الثنائية مستخدمين النوافذ في عائلة شفارتز .

Introduction

We give necessary and sufficient conditions for $g \in W(L^{\infty}, e^{1})$ to generate a Gabor frame over certain irregular lattices .

It is well known that if a Gabor system $G(\Lambda, g)$ is complete and Λ is a lattice then $D(\Lambda) \geq 1$, where $D(.)$denotes the Beurling density. But what if Λ is a subset of a lattice but is not itself a lattice ? We investigate this question here .

Let $g \in L^2(\mathbb{R})$ be a compactly supported function, whose integer-translates $\{T_k g\}_{k\in\mathbb{Z}}$ form a partition of unity. We show that for certain translation and modulation parameters, such a function g generates a Gabor frame, with a (noncanonical) dual generated by a finite linear combination h of the functions $\{T_k g\}_{k\in\mathbb{Z}}$; the coefficients in the linear combination are given explicitly. Thus, h has compact support and the decay in frequency is controlled by the decay of $\hat{g}$. In particular, the result allows the construction of dual pairs of Gabor frames, where both generators are given explicitly, have compact support, and decay fast in the Fourier domain

A method is presented for constructing dual Gabor window functions that are polynomial splines. The spline windows are supported in [−1, 1], with a knot at x = 0, and can be taken C^m smooth and symmetric.

A technique of producing signals whose energy is concentrated in a given region of the time-frequency plane is examined. The degree to which a particular signal is concentrated is measured by integrating the Wigner distribution over the given region. This procedure was put forward by Flandrin, and has been used for time-varying filtering in the recent work of Hlawatsch, Kozek, and Krattenthaler .

we consider localization operators on $L^2(\mathbb{R}^d)$ defined by symbols in a subclass of the modulation space $M^{\infty}(\mathbb{R}^{2d})$.

we introduce and study a concept to assign a shift-invariant weighted Gabor system to an irregular Gabor system while preserving special properties such as being a frame. First we extend the notion of Beurling density to weighted subsets of $\mathbb{R}^d$. We then derive a useful reinterpretation of this definition by using arbitrary piecewise continuous, positive functions in the amalgam space $W(L^{\infty}, L^{1})$ to measure weighted Beurling density, thereby generalizing a result by Landau in the non-weighted situation .

We give a characterization for the weighted irregular Gabor tight frames or dual systems in $L^2(\mathbb{R}^n)$in terms of the distributional symplectic Fourier transform of a positive Borel measure on $\mathbb{R}^{2n}$ naturally associated with the system and the short-time Fourier transform of the windows in the case where the window (or at least one of the windows in the case of dual systems) belongs to $S(\mathbb{R}^n)$.

We provide explicit constructions of particularly convenient dual pairs of Gabor frames. We show that arbitrary polynomials restricted to sufficiently large intervals will generate Gabor frames, at least for small modulation parameters. Unfortunately, no similar function can generate a dual Gabor frame, but we show that almost any such frame has a dual generated by a B-spline

Consider a bounded function g supported on [−1, 1] and a modulation parameter $b \in]1/2,1[$ for which the Gabor system $\{E_{mb}T_n g\}_{m,n\in\mathbb{Z}}$ is a frame. We show that such a frame always has a compactly supported dual window.

We study a class of pseudodifferential operators known as time–frequency localization operators, Anti-Wick operators, Gabor–Toeplitz operators or wave packets. Given a symbol a and two windows φ_1, φ_2, we investigate the multilinear mapping from $(a, \varphi_1, \varphi_2) \in L'(\mathbb{R}^{2d}) \times L(\mathbb{R}^d) \times L(\mathbb{R}^d)$ to the localization operator $A_a^{\varphi_1,\varphi_2}$ and we give sufficient and necessary conditions for $A_a^{\varphi_1,\varphi_2}$ to be bounded or to belong to a Schatten class.

We give a new characterization of the Gelfand triple of function spaces in (s_0, L^2, S_0') by means of a family of time-frequency localization operators. The localization operators are defined by the short-time Fourier transform and determine the local time-frequency behavior, whereas the global time-frequency distribution is characterized by a sequence space norm .

We study families of time-frequency localization operators and derive a new characterization of modulation spaces.

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