

THE BALIAN-LOW THEOREM IN THE FINITE DIMENSIONAL SETTING

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The classical Balian-Low theorem states that if both a function and its Fourier transform decay too fast then the Gabor system generated by this function (i.e. the system obtained from this function by taking integer translations and integer modulations) cannot be an orthonormal basis or a Riesz basis.

Though it provides for an excellent ‘thumbs-rule’ in time-frequency analysis, the Balian-Low theorem is not adaptable to many applications. This is due to the fact that in realistic situations information about a signal is given by a finite dimensional vector rather than by a function over the real line. In this work we obtain an analog of the Balian-Low theorem in the finite dimensional setting, as well as analogs to some of its extensions. Moreover, we will note that the classical Balian-Low theorem, and its extensions, can be derived from these finite dimensional analogs.

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