Scattering effect analysis of elastic wave concentrator based on FRFT

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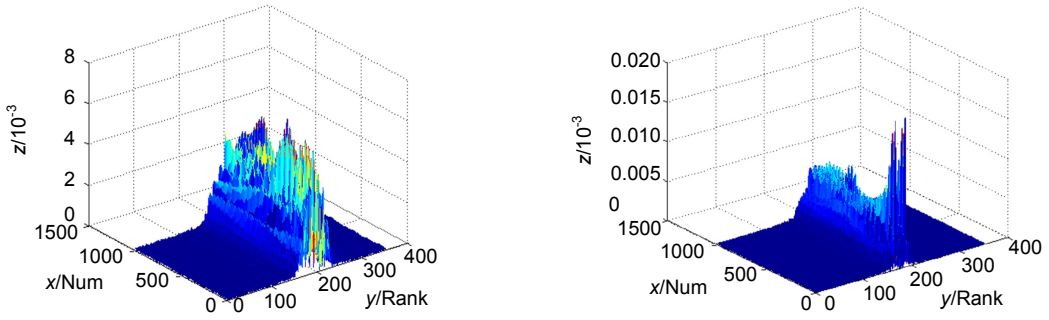

Three dimensional energy distribution of FRFT for spatial signal

Overview: The elastic particles are deviated from the equilibrium position under the elastic force. The stress in the particle changes or produces vibration. This change at the same time leads to a stress change and vibration of the surrounding particles. The mechanism of the elastic wave is more complicated than that of the electromagnetic wave, because its propagation relies on medium. This is a typical inverse question. It is difficult to design medium parameters when controlling the direction of the elastic wave. In order to obtain precise results of elastic wave propagation, the equations were simplified or approximated to achieve the design effect, depending on the actual situation (such as high frequency). The elastic is widely used in many domains. In some space, the special demand is presented, such as the cloak. The objects enclosed inside this region cannot be impinged by the illumination light and hence are invisible to the outside observers. The concentrator is also applied to control the energy concentrated in a special zone, in order to highlight this domain. Therefore, as impedance matching and lossless dielectric material requirements are difficult to meet, the scattering phenomenon appears in the design of elastic wave propagation in the process of the device. It is a way and a tool in the evaluation of the elastic wave device design. The size of the scattering phenomenon marks the design effect. In some case, this is judged by our eyes. It is qualitative. Usually, the scattering wave is a variable frequency signal. The fractional Fourier transform (FRFT), which has good focusing characteristic, is adaptive to analyze frequency variation signal. It is a new attempt to transform the time and frequency domain to spatial frequency. The spatial signal in the propagation direction also has the same characters as the signal of time. The result of this transformation has turned the scattering problem into a signal analysis and processing problem. As this, the method of signal can be used to process these questions, such as the wavelet transform, Gabor transform and FRFT. Especially the FRFT, the focusing characters to the chirp signal, which can be used to analyses the spatial signal. The frequency change rate provides a quantitative description method of elastic scattering wave propagation control. With the FRFT, it reduces the blindness of scattering degree of cognitive, simplifying the dielectric become evaluation of design. This method is suitable for the signal of frequency changes, in many cases, the scattering is also complex, and it needs to analyze the reasons and characters of these phenomena and the corresponding method are brought.

Citation: Lu X Y, Sun L J, Fang X Q, *et al*. Scattering effect analysis of elastic wave concentrator based on FRFT[J]. *Opto-Electronic Engineering*, 2018, **45**(6): 170739

Supported by Natural Science Fund of Henan Province Ducation Department, application of fractional Fourier transform in scattering analysis of elastic waves (15A140016), and the basic and research fronts of Henan Province Science Department and Research on intelligent lubrication technology of railway track curve (62300410200)
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