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An experimental observation of the spatial motions of strings in resonance points under the planar excitation

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Abstract: In general, strings are resonated when the excitation frequency is in the neighborhood of natural frequency by planar excitation. It is a primary resonant phenomenon. And they are also resonated by three times frequency of the natural one under the external excitation. This phenomenon is called superharmonic resonance. In this study, we consider the case when the lower end of a string is excited periodically by shaker in a direction which is perpendicular to the longitudinal one and the other upper end is fixed. Then, we show experimentally nonlinear phenomena in strings by frequency response curves. As a result, we found out that spatial motion can occur by superharmonic resonance. Finally, we observe the occurrence of the out of plane or spatial motions through the experiments. These phenomena are caused by the coupling effect of the stiffness due to the characteristic of the geometrical cubic nonlinear restoring force in strings.

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