

Supratransmission-induced discrete rogue wave in nonlinear chain

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Abstract—We numerically generate a discrete rogue wave in a chain of a nonlinear pendulum using the nonlinear supratransmission way and the instability of shaken pendulum. This could open the way for the application of discrete rogue waves within simple devices.

1. Introduction

Since the pioneering work by Geniet and Léon [1] on the nonlinear supratransmission phenomenon, the behavior of the plane wave in the forbidden band has fascinated several researchers. Nowadays, the nonlinear supratransmission phenomenon appears to be a way to generate travelling solitons such as symmetric (asymmetric) breather [2] and kink [3] to mention a few. Can rogue waves be generated by a nonlinear band gap transmission way? Answer this question is the aim of this work.

2. Mathematical description of the model

Let us consider the equation of motion of the n th pendulum in the form[4, 5]:

$$\ddot{\theta}_n - c(\theta_{n+1} + \theta_{n-1} - 2\theta_n) + \sin(\theta_n) + f\omega^2 \cos(\omega\tau) \cos(\theta_n) = 0, \quad (1)$$

The numerical simulation of equation (1) submitted to the periodically driven edge and parametric excitation is given in figure 1.

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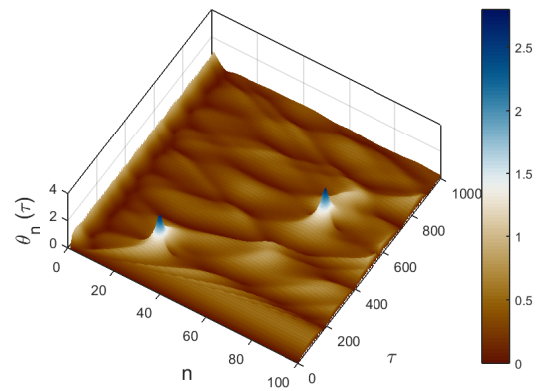


Figure 1: $f=0.026$; $c=1$; $\omega = 0.95 \text{ rad.s}^{-1}$.

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