POPSICLE CHAIN REACTION

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ABSTRACT

When a number of Popsicle sticks are interlocked in each other, a mesh is produced, known as "The Cobra Wave". As one of the sticks from the end of the lattice is taken out, an explosion is happened and the wooden sticks will be thrown consecutively, one after another. In this research this phenomenon was investigated and the affect the chain reactions was shown by using different sizes of popsicle.

(This is just a short explanation)

1 Introduction

Wooden Popsicle sticks can be joined together by slightly bending and make a “cobra wave” chain. It was seen that by increasing the length, in popsicle chain, moving speed decreases. Also the thicker popsicle lead higher speed. The elasticity (The Young's modulus) and the mass of the popsicle has effects on the height of the cobra and the shape of the wave. The width will not change the speed of the explosion. So we realized that it happens because of the tension between the objects in this system and some parameters which can affect on the structure of curves like the distance between sticks, angle between sticks, numbers of sticks and other parameters.

2 Experimental Procedure

In the Cobra Wave, the sticks interlink in each other and a lattice will be formed. First, we create the chain and then shoot it . Our variables are the number of woods, the angle between the woods and, of course, which side of the wood we take from. The phenomenon was investigated by utilizing popsicle in 4 different dimensions (width, thickness and length) in order to construct the cobra wave pattern (Fig 1).

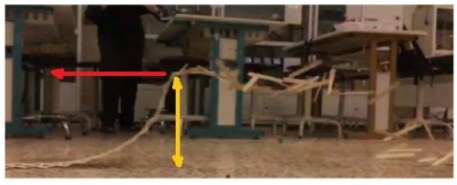

Fig.1: A side view of the observed phenomenon

In our experiment the floor is flat, with low friction . Then we arrange a pattern by connecting sticks together with constant material, size, distance (from each other), length and angle (between them) (Fig. 2). Due to the bending of the woods, potential energy is stored in the chain, and then this energy becomes a kinetic energy and the wave forms inside the chain.

Popsicle will release its Potential Energy (PE) ,if we make free the last stick of the chain and it will be thrown and make a shape like a wave which is tracked by tracker (Fig. 3).

Fig.2: A popsicle pattern

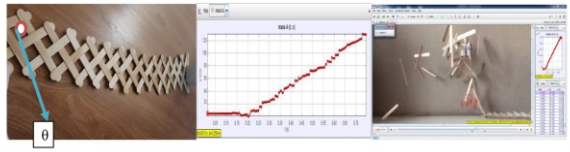

Fig. 3: Releasing the sticks in popsicle (analyzing by tracker)

In our first experiment, we fixed the numbers of sticks and tested different distances (from each stick to the other one) and measured the leaping height. Then we increased the numbers of sticks and fix the distance between sticks, the height of leaping gets higher.

The phenomenon was observed using a 120 frame/ sec camera. The behavior was investigated from two aspects:

- 1) Every single Popsicle and
- 2) A linear continuous medium (Cobra Wave).

It was seen that the height of the wave changes in the explosion for each of the 4 waves. Its height was measured by pointing the center of one chosen Popsicle in 'Tracker" software (it can be measured directly by measuring the height of the highest thrown Popsicle).

3 Results and Discussion

The most relevant parameters for the velocity and the height of the explosion were the length, width, thickness, mass, young's modulus, special period of the mesh and θ (the angel of the lattice, a scaling factor which depends on the geometry of the mesh). It was realized that the width of the sticks doesn't effect on the velocity. The highest changes (especially on the velocity) were obtained by changing the θ angel. As was seen in the experiments, a deformation was observed all over the chain, which was because of the elastic energy. In all the waves, Potential

Energy (PE) was stored in the mesh and by releasing one of the two Popsicle, which are placed in the edges, the stored energy was converted to Kinetic Energy (KE) and explosion was happened. From the balance between the Kinetic Energy (KE) and the Potential Energy (PE), velocity of the wave was derived as: b (θ) (e2/L2) √ (E/ρ)(Fig. 4).

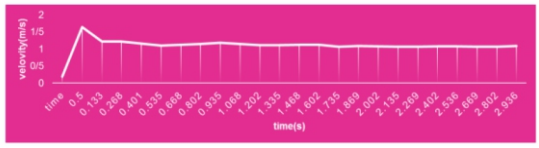

Fig. 4: Wave's speed (m/s)

As the results , when the angle is smaller, the contact surface of the wood is more and more combined, so the energy will be increased . Conversely, when angle becomes larger, the contact surface of the wood is reduced and the lower energy causes the lower height .

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