

### **THE MOVEMENT MODELLING BY GRAVITATIONAL ATTRACTIONS**

Multi-functional entertainment complexes are popular in the leisure industry. Gravity attractions are used for children's family and extreme entertainment. Improving reliability and safety of the attractions on the basis of gravity chutes is a complex technical problem facing the designers and staff.

The movement modes and the forces acting on the slides user's attractions have been analyzed to determine safe speeds and optimal geometric dimensions during their designing. Mathematical models have been proposed. There are differential equations of motion obtained by analyzing the forces acting on the trigger object.

Differential motion equations are as follows:

$$m \frac{d^2 S}{dt^2} - mg \sin \alpha + fmg \cos \alpha = 0, \quad (1)$$

$mg \sin \alpha$  — download force;  $m \frac{d^2 S}{dt^2}$  — Newton's inertia;  $fmg \cos \alpha$  — the power friction;  $S$  — glide path;  $f$  — the friction coefficient;  $m$  — the object mass

Consider the case where the friction coefficient does not depend on the speed  $f = \text{const}$ . The equations solving (1) at primary conditions  $t=0 \Rightarrow S(t)=0$ ;  $ds/dt=V_1$  will look like:

$$S(t) = \frac{1}{2} (g \sin \alpha - fg \cos \alpha) t^2 + V_1 t. \quad (2)$$

After performing the equation differentiation (2), we find the slide

$$\text{speed } V = (g \sin \alpha - fg \cos \alpha) t + V_1.$$

If the equation differential (1) to add a centrifugal force that allows the curvature of the track force, the models make it possible to perform calculations of both the individual chute elements, and its operating parameters in general. On this basis, it can be possible to determine the trajectory, velocity of the objects that different in size, shape and surface properties are guaranteed to be safe for both visitors and staff serving them.

The practical application of the obtained mathematical models will ensure the safety of staff and users with optimal positive emotional effect.

**KEY WORDS:** *attractions, chute calculation, gravity chutes, motion equation, punch, pickles*