CENTRIFUGAL EFFECT

This animation forms part of a pair of rotation effect animations that complement each other. The other rotation effect animation is called coriolis effect.

This animation represents the case of an object sliding frictionless over the surface of a flat disk that is rotating. I will call the object 'the puck', as in ice hockey.

The disk supports the weight of the puck, but as there is no friction the rotation of the disk does not affect the motion of the puck. In other words: there's no dynamics going on; there is no exchange of momentum, no change of kinetic energy.

View

The two circles with quadrants represent a disk. The left view shows the disk from a stationary point of view. The view on the right is the same disk, as seen from a co-rotating point of view. It's the view you would get if a video camera is suspended above the disk, co-rotating with it.

Controlling the animation

The two elements underneath the two disks are sliders for interaction with the animation. When the animation is running the two sliders are temporarily not displayed.

The button 'reset' halts the animation and returns the position of the object to the starting point, but the settings are kept. 'Reset all' preserves nothing; it resets to the same state as when the webpage loaded.

About the checkbox 'apply auto halt': the puck moves in a straight line, so once it has left the frame of the animation it's gone. There's no point in continuing to run the animation after that, hence the auto halt feature.

Evolution of the display

When a run starts the puck is initially co-rotating with the disk, as an object that is held rigidly in place. After a full revolution the puck is released and from then on it moves in a straight line.

The slider on the right can be moved from -2 to 1. With the default setting of '0' the puck has initially no velocity relative to the disk. That is, when the setting is '0' the released puck moves over the disk with the velocity of its co-rotating motion. For velocity settings between -1 and 0 the puck moves *forward*, even though it is released *backwards* relative to the disk. That is, for the (-1,0) range the launch reduces the velocity of the puck, but doesn't reverse it.

Both when launched forward and when launched backward the puck proceeds *away* from the rotation axis of the disk. On release the direction of motion is tangential to circling the center, and there is no centripetal force, so the motion of the puck will always be away from the center.

I refer to this rotation effect as 'centrifugal effect': the puck is always going to move away from the center. By contrast: the distinguishing feature of the Coriolis effect is that the acceleration with respect to the rotating system is the same for any direction of velocity relative to the rotating system. In the above centrifugal effect simulation you see that when the puck is launched backward it moves in a direction *away*from the rotation axis, whereas in the case of the Coriolis effect an object that moves backward (with respect to the rotating system) will move *closer to the central axis of rotation*

Of course, as the puck moves away from the center of the rotating disk the difference in velocity between the puck and the part of the disk where it is located becomes larger and larger. The velocity of the puck remains the same, but the parts of the disk far away from the center have a larger velocity, so the puck's velocity *relative to the disk* keeps increasing. The Coriolis vector is proportional to the velocity relative to the rotating system and pretty soon the Coriolis vector is larger than the centrifugal vector. But it's still not the Coriolis effect, for the puck still keeps moving *away* from the disk's rotation axis.

Motion in a straight line

Summerizing: the centrifugal effect is a consequence of the fact that the puck is moving in a straight line.

Source : http://www.cleonis.nl/physics/graphlets/centrifugal_effect.php