Handling the Centre of Mass

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We will present some activities related to the concept of “Centre of Mass” which can be implemented in elementary/intermediate and advanced levels and are related to the contents taught.

The methodology used has involved the construction of some didactic devices, easily conceived, which will become attractive to the public in general and make the interactivity possible.

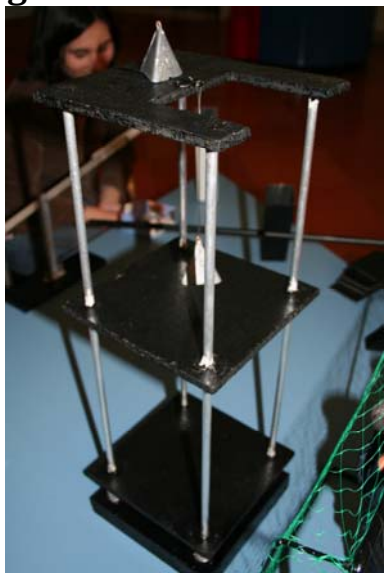
Some activities:

A building with a seismic structure

This object allows you not only to understand how an anti-seismic structure works but also allows you to analyse how the stability of the structure is dependent upon the position of the centre of mass.

By slightly modifying the position of the centre of mass you quickly realize that a structure with lhe same disturbance will suffer a stronger oscillation.

So, the lower the centre of mass of a building is, the steadier it will remain.



Bicycle in balance

In this case, the structure attached to the bicycle places the centre of mass of the whole below the wire. This situation allows the bicycle to remain on the wire since the whole is in balance.

The bicycle wheel

Have you got strong arms?

The aim of this experiment is to hold the rotating wheel with your hands without oscillating.

Can you do that?

No, you cannot keep it from wabbling because the centre of mass does not coincide with the geometric centre of the wheel.

The wheel contains a piece of lead which changed the position of the centre of mass and consequently the position of the axis of rotation.

Kinetic attrition vs normal reaction

The wheels turn in opposite directions: the one on the left turns clockwise; the one on the right turns counter-clockwise.

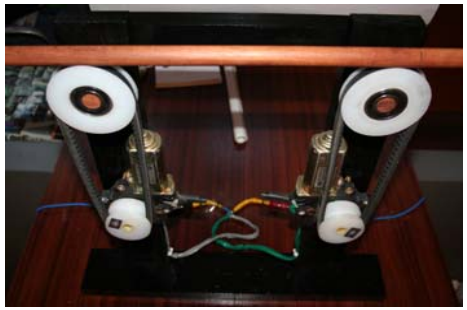
What happens when you put a bar on them?

The bar moves from one side to the other without falling down.

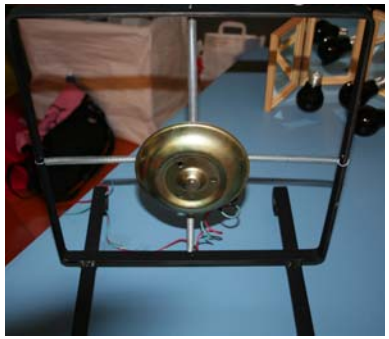
Why is this?

When the centre of mass of the bar comes close to one of the wheels the force on the wheel increases as well as the intensity of attrition.

With increasing intensity of attrition the bar is pushed across to the other wheel where the same occurs.



The axis of rotation vs the position of the centre of mass



This object is composed of four springs attached to an electric engine with a disk whose axis of rotation is not in the centre.

What happens when the disk starts to rotate?

Initially the structure shows a chaotic movement but as the speed of rotation of the disk increases the system gets in balance and starts to rotate around its centre of mass. It means that any body in rotation has a tendency to turn around its centre of mass.

The springs absorb the vibration thus allowing the whole engine/disk to move freely.