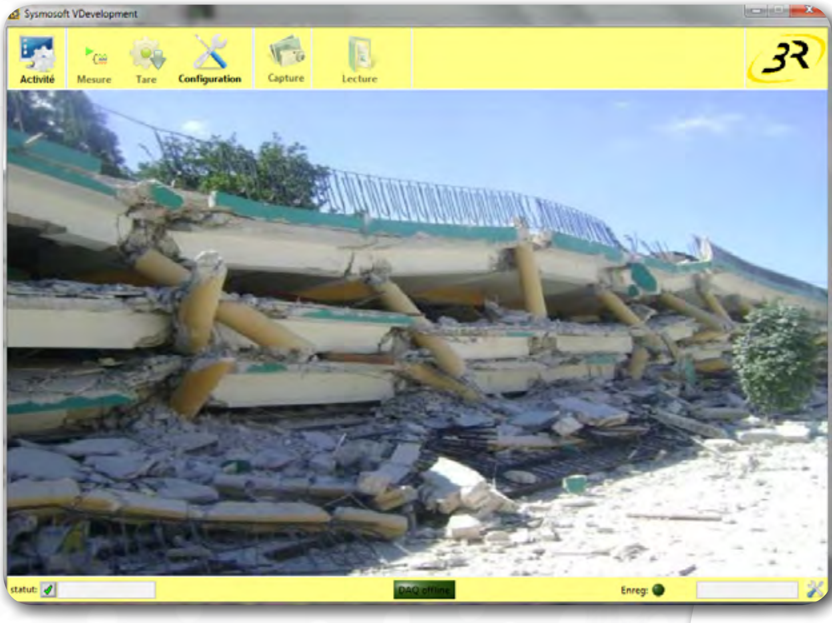


$$\Sigma \vec{F} = m\vec{a}$$

• EARTHQUAKE SIMULATOR • Sysmo

Educational tools :

To make students understand the link between earthquake frequency and their dangerousness.

Study of civil engineer's complex structures is essential to ensure constructions safety and durability.

This testing rig allows studying several technical solutions to experiment on structures facing seismic shakings: accorded-mass system, structure strengthening, height, neoprene supports, soil liquefaction.

The revolving plate allows to visualize the stress effect on different angles of the excitation incidence.

The removable structure elements allow the visualization of their efficiency to fight seism effects.

1 • THE FIGHT AGAINST EARTHQUAKES

Even though we cannot escape from it, we can protect ourselves against it, for instance by building and designing "anti-seismic" structures.

An earthquake is a ground movement characterized by oscillations in three directions; the effects of these oscillations on buildings can be considerable.

The building's oscillatory movement induced by seism being very fast, and the mass of buildings usually being important, it appears on the very important inertia forces balance and described in the 2nd Newton law :

Force = Mass (of the building) multiplied by acceleration

$$\sum \vec{F} = m\vec{a}$$

Houses and common structures are designed to support their own weight, they hence resist rather well to the vertical component of seism.

This is not the case of the horizontal component, often not being taken into account or underestimated, which then provokes important damages sometimes leading to full destruction of the building.

For practical and economical reasons, the anti-seismic constructions are calculated to resist the strongest earthquakes, even if, in some cases, some feeble injuries appear (such as small cracks), which are acceptable because it does not compromise the building stability.

Other buildings, having a safety function or being of high importance, such as nuclear plants or hospitals, must respect an injury factor almost nil even after a major seism.

Sysmo

2 • THE 3R SIMULATOR

DEVICE FOR VIZUALISING EFFECTS OF EARTHQUAKES SOLLICITATIONS ON A STRUCTURE

Specifications:

- Heavy frame, mechanically welded lacquered sheet, mounted on anti-vibration blocks
- Swinging platen on springy posts, with indexable revolving plate
- Excitator with adjustable frequency from 0 to 20Hz, stroke 2mm
- Different structures in stainless steel sheet representing a building, with its floors, struts, suspension, pendulum mass and removable braces

- Control panel with a disconnecting switch, on/off switch, frequency adjustment (0 to 20 Hz)
- Supply 230V 50Hz 0.25kW
- Dimensions : L= 400 x l=400 x h= 220 mm
- Weight : approximately 40 kg

3 • OPTION : INSTRUMENTATION

MEASURE AND DISPLAY DEVICE OF THE ACCELERATIONS ON A STRUCTURE SUBJECT TO A SEISM

Included :

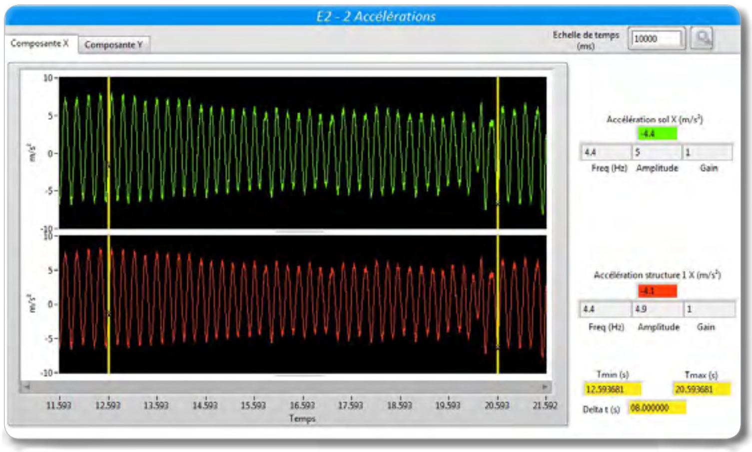
- Two triaxial accelerometers +/-30m/s^2 (3g) in metallic cases, to be fixed in two points of the structure
- Power supply and packaging box up to 4 sensors, 8 USB outputs
- **Labview display Software**

No contractual Pictures

ACQUISITION AND MEASUREMENT SOFTWARE LABVIEW DISPLAY INSTRUMENT

It allows user to :

- Visualize the evolution of accelerometers signals
- Filter signals
- Calibrate each channel independently
- Measure the signal frequency
- Measure the amplitude of signals
- Measure the ratio between channels amplitudes



4 • PROPOSED ACTIVITIES

The pack includes :

- **A detailed booklet**
- **A CD-rom with templates (Scilab, RDM6, CREO...)**
- **Types of recording**

1) Free oscillations : influence of the mass, influence of the stiffness, link mode
2) Forced oscillations :
   - *influence of the mass,*
   - *influence of the stiffness,*
   - *linked mode,*
   - *accorded mass dampers (optional), ,*
   - *vibratory isolation,*
   - *soil liquefaction (optional)*

3) Characterization of structures (stiffness, natural frequency)
4) Analytic Solution of motion equations
5) Solving equations of motion using a numerical calculation software (ex: Scilab)
6) Modelling and dynamic calculations of structures in 2D finite elements (ex: RDM6)
7) Modelling and dynamic calculations of structures in 3D finite (ex: CREO)
8) Protection against earthquakes: regulation, zoning, importance coefficient, soil condition
9) Calculations of standard solicitations: acceleration, periods…
10) General Principles of design: location, conception, execution
11) Construction techniques: strengthening of the structures, isolation of the structures, motion compensation

No contractual Pictures