Technology. Structures

IES Radio Exterior de Alicante

Bernabé Álvarez Ruiz[1]

http://cienciasfera.com
http://tusmates.es

January 13, 2018

[1] bernabealvarez@gmail.com

Outline

Structures

Classification of Structures.

Ancient structures and nowadays.

Nowadays.

Forces and loads.

Stress and types of stress.

Structural conditions.

Artificial structures.

Structural elements.

References.

Structures.

Definition. Examples.

Structures: set of elements destined to support forces. The structure prevents from breaking or deforming. Examples:

Figure: An artificial island.

Figure: A web spider.

Structures.

Examples.

Figure: The castle of Alicante. Spain.

Figure: A honeycomb.

Structures.

Examples.

Figure: Hogueras in Alicante. Spain.

Figure: A seashell.

Structures.

Classification of Structures.

There are two types of structures:

- Natural structures.
- Man-made structures.

The last slides there were examples! (on the right-hand natural[2] and on the left-hand man-made[3]).

[2] This is a natural structure...

[3] This is a man-made structure...

Structures.

Ancient structures and nowadays.

Let's practise! Exercise

Structures.

Ancient structures and nowadays.

Now, we know what a structure is and its classification. But, what is the difference between structures in Romans and we?

Structures.

Ancient structures and nowadays.

Now, we do calculate everything. We need to know Maths. See next examples.

Structures.

Ancient structures and nowadays.

Figure: Colosseo. Roma. Italy.

Structures.

Ancient structures and nowadays.

Figure: Estádio Nacional Mané Garrincha. Brasilia. Brasil. Photo.

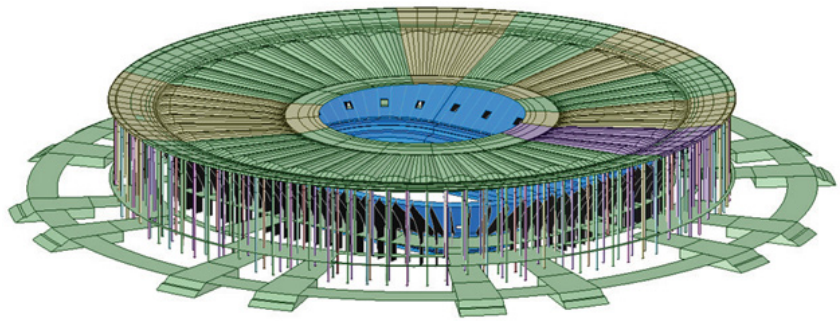

Figure: Estádio Nacional Mané Garrincha. Brasilia. Brasil. Geometrical model for CFD analysis.

Structures.

Ancient structures and nowadays.

Figure: Aqueduct of Segovia.

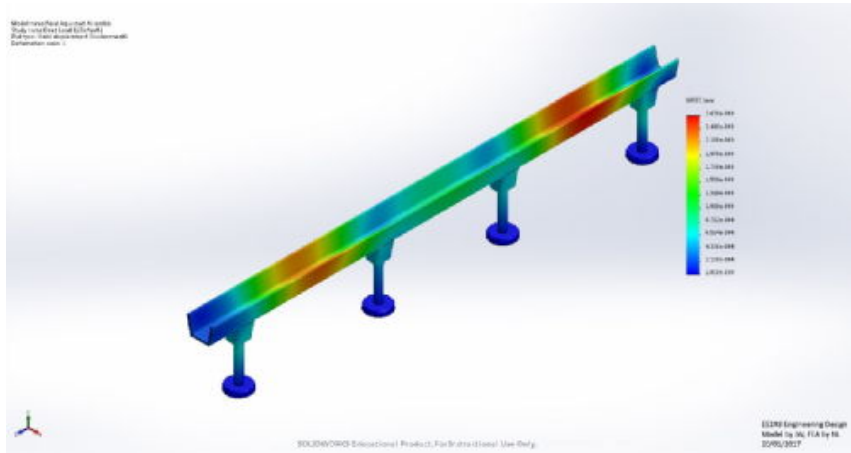

Figure: Geometrical model for CFD analysis.

Structures.

Ancient structures and nowadays.

Figure: Wind turbine.

Structures.

Ancient structures and nowadays.

Figure: Wind turbine.

Basic concepts:

Structures.

Ancient structures and nowadays.

Figure: Wind turbine.

`Basic concepts:`

- Using maths we can simulate all situations. ▸ Cars crash

Structures.

Ancient structures and nowadays.

Figure: Wind turbine.

`Basic concepts:`

- Using maths we can simulate all situations. ▸ Cars crash
- Computer Science is also need it.

Structures.

Ancient structures and nowadays.

Figure: Wind turbine.

`Basic concepts:`

- Using maths we can simulate all situations. ▸ Cars crash
- Computer Science is also need it.
- The latest articles, books, programs are in English.

Structures.

Ancient structures and nowadays.

Figure: Wind turbine.

`Basic concepts:`

- Using maths we can simulate all situations. ▸ Cars crash
- Computer Science is also need it.
- The latest articles, books, programs are in English. That's we do!!

Structures.

Nowadays.

Now, we know Maths, Computer Sciences, and English. But sometimes we're wrong: ▸ Tacoma Bridge Collapse

That's why, the more I'm wrong, the more I learn.

Structures.

Forces and loads.

Now, we know what a structure is, its classification and why we need know maths. But, what a force is? ▸ Video

Structures.

Forces and loads.

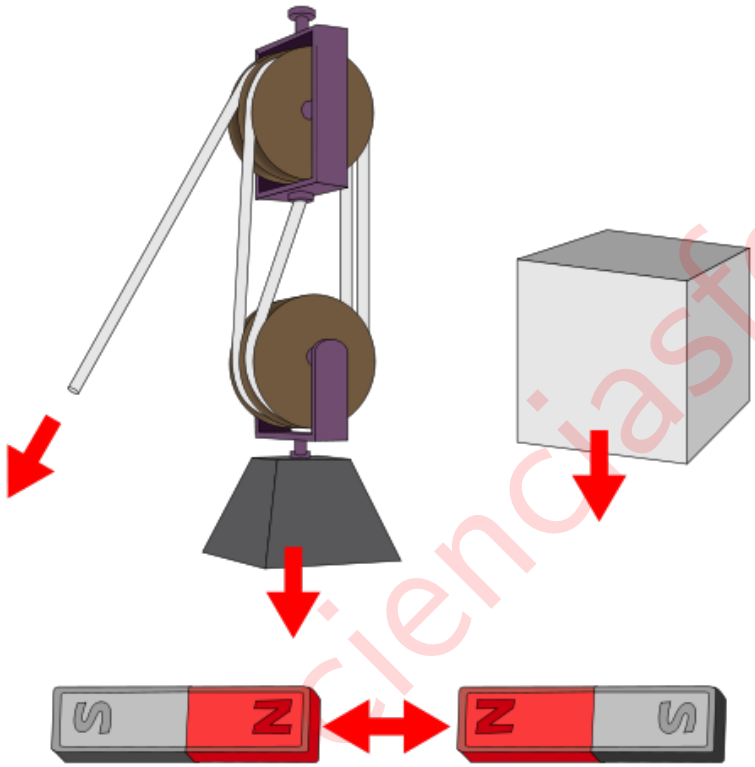

Figure: Different types of forces.

Structures.

Forces and loads.

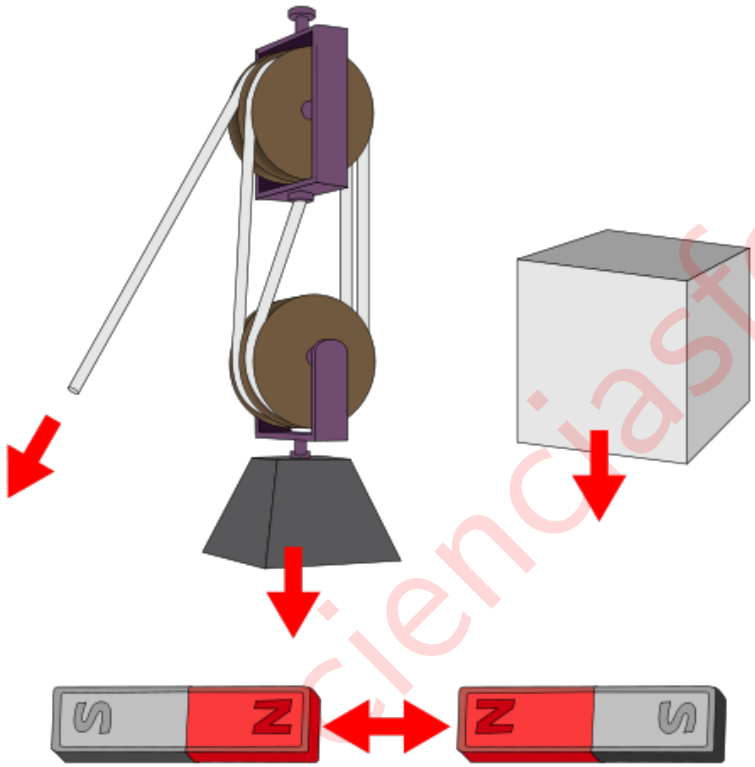

Figure: Different types of forces.

Force: all that capable of

- Deform a body (static effect).
- Change their movement (dynamic effect).

It is measured in newtons (N).

Structures.

Forces and loads.

A load is a force acting on a structure.

Structures.

Forces and loads.

A load is a force acting on a structure. Types of loads:

Structures.

Forces and loads.

A load is a force acting on a structure. Types of loads:

Fixed or permanent loads: do not change with the time.
Examples:

Variable loads: do change with the time. Examples:

Structures.

Forces and loads.

A load is a force acting on a structure. Types of loads:

Fixed or permanent loads: do not change with the time.
Examples:

- The structure own weight.

Variable loads: do change with the time. Examples:

Structures.

Forces and loads.

A load is a force acting on a structure. Types of loads:

Fixed or permanent loads: do not change with the time.
Examples:

- The structure own weight.
- The weight of the elements.

Variable loads: do change with the time. Examples:

Structures.

Forces and loads.

A load is a force acting on a structure. Types of loads:

Fixed or permanent loads: do not change with the time.
Examples:

- The structure own weight.
- The weight of the elements.

Variable loads: do change with the time. Examples:

- Wind, snow, traffic and so on.

Structures.

Forces and loads.

A load is a force acting on a structure. Types of loads:

Fixed or permanent loads: do not change with the time. Examples:

- The structure own weight.
- The weight of the elements.

Variable loads: do change with the time. Examples:

- Wind, snow, traffic and so on.
- Earthwake.

Structures.

Forces and loads.

A load is a force acting on a structure. Types of loads:

Fixed or permanent loads: do not change with the time. Examples:

- The structure own weight.
- The weight of the elements.

Variable loads: do change with the time. Examples:

- Wind, snow, traffic and so on.
- Earthwake.
  - Workshop
  - simulation
  - exercises
  - torsion
  - choque de coches

Structures.

Stress.

We have been studying structures, forces and loads. Now we are going to investigate in what happens inside the object.

Structures.

Stress.

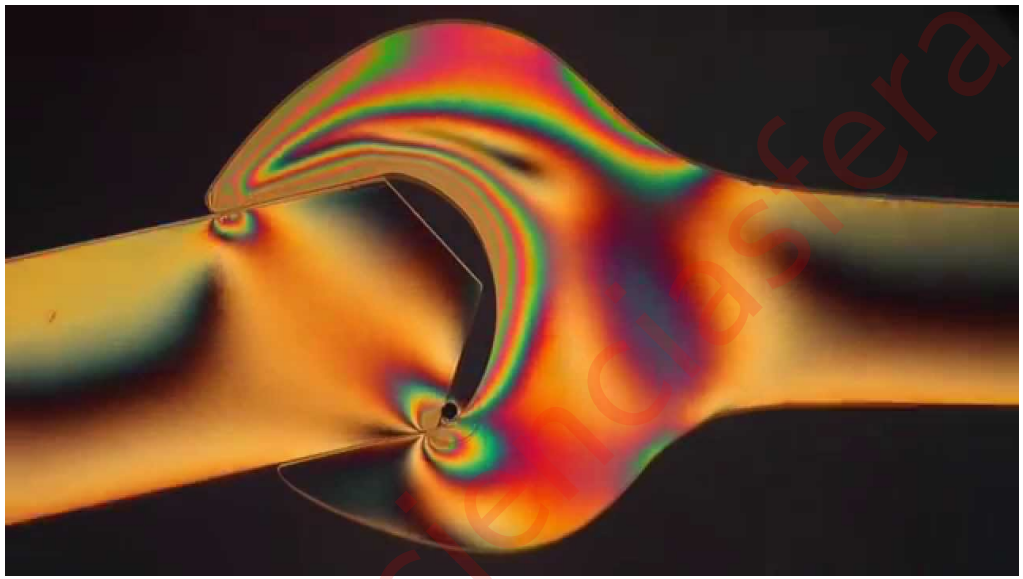

Figure: Internal forces in a wrench.

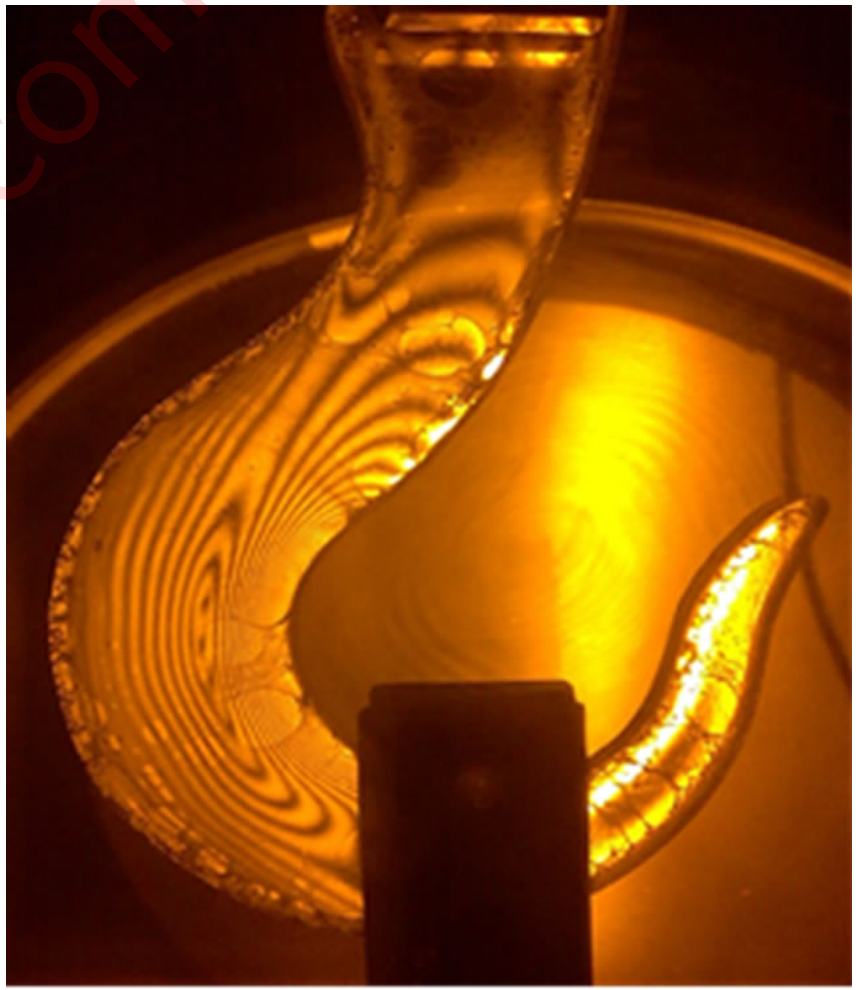

Figure: Internal forces in a hook.

Structures.

Stress.

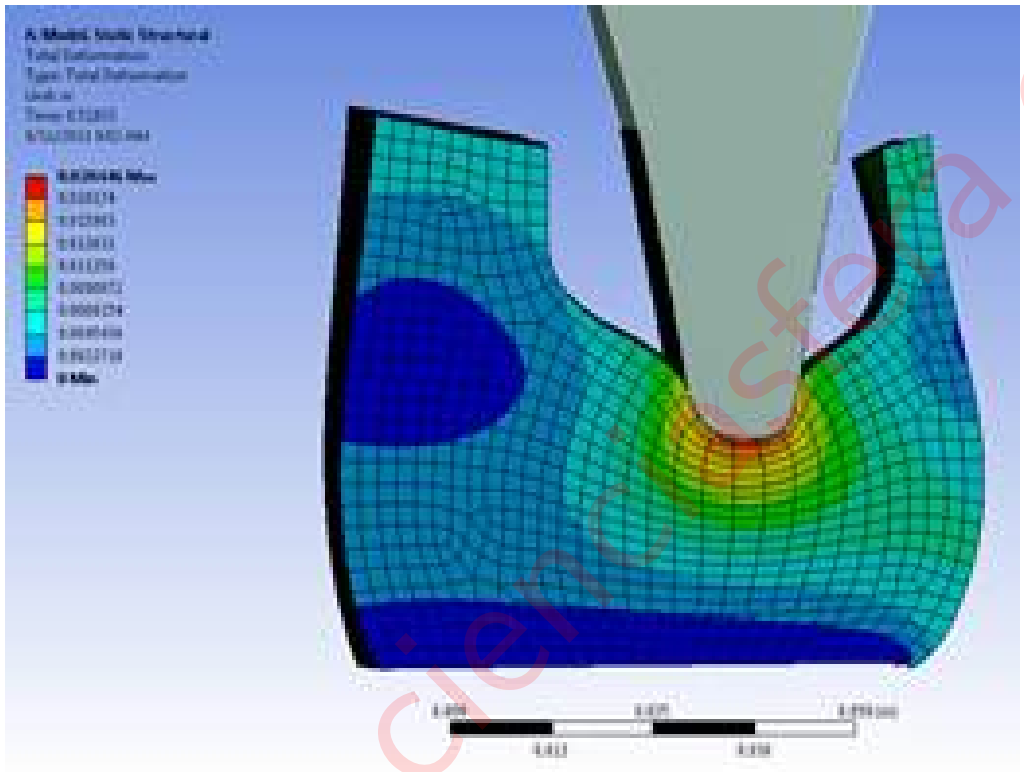

Figure: Internal forces in a mechanical element.

Stress

It is defined as an internal force.

It is what happen inside the material.

Structures.

Stress. Type of stress

Type of stress

There are five kind of stress:

- Traction.
- Compression.
- Bending
- Shearing or cutting.
- Torsion.

We are going to study all cases.

Structures

Activities!

1. Let's understanding ! ▸ Task 2 ▸ Video
2. Let's draw activity ! ▸ Task 3
3. Let's analyze activity. ▸ Task 4

Let's do a quizziz ▸ Ask to the teacher for the code!!!
Let's use some flash cards ▸ Structures

Structures

Question: Define traction

1. Two forces are applied in the same direction with a tendency to lengthen it.
2. Two opposing forces are applied in the same direction tending to shorten it.
3. Two opposing forces tending to cut it.
4. Two opposing forces that tend to twist it.
5. One or more forces tend to bend the object.

Structures

Question: Define traction

1. Two forces are applied in the same direction with a tendency to lengthen it. Correct!!
2. Two opposing forces are applied in the same direction tending to shorten it.
3. Two opposing forces tending to cut it.
4. Two opposing forces that tend to twist it.
5. One or more forces tend to bend the object.

Structures

Question: Define compression

1. Two forces are applied in the same direction with a tendency to lengthen it.
2. Two opposing forces are applied in the same direction tending to shorten it.
3. Two opposing forces tending to cut it.
4. Two opposing forces that tend to twist it.
5. One or more forces tend to bend the object.

Structures

Question: Define compression

1. Two forces are applied in the same direction with a tendency to lengthen it.
2. Two opposing forces are applied in the same direction tending to shorten it. Correct!!
3. Two opposing forces tending to cut it.
4. Two opposing forces that tend to twist it.
5. One or more forces tend to bend the object.

Structures

Question: Define bending

1. Two forces are applied in the same direction with a tendency to lengthen it.
2. Two opposing forces are applied in the same direction tending to shorten it.
3. Two opposing forces tending to cut it.
4. Two opposing forces that tend to twist it.
5. One or more forces tend to bend the object.

Structures

Question: Define bending

1. Two forces are applied in the same direction with a tendency to lengthen it.
2. Two opposing forces are applied in the same direction tending to shorten it.
3. Two opposing forces tending to cut it.
4. Two opposing forces that tend to twist it.
5. One or more forces tend to bend the object. Correct!!

Structures

Question: Define torsion

1. Two forces are applied in the same direction with a tendency to lengthen it.
2. Two opposing forces are applied in the same direction tending to shorten it.
3. Two opposing forces tending to cut it.
4. Two opposing forces that tend to twist it.
5. One or more forces tend to bend the object.

Structures

Question: Define torsion

1. Two forces are applied in the same direction with a tendency to lengthen it.
2. Two opposing forces are applied in the same direction tending to shorten it.
3. Two opposing forces tending to cut it.
4. Two opposing forces that tend to twist it. Correct!!
5. One or more forces tend to bend the object.

Structures

Question: Define shear

1. Two forces are applied in the same direction with a tendency to lengthen it.
2. Two opposing forces are applied in the same direction tending to shorten it.
3. Two opposing forces tending to cut it.
4. Two opposing forces that tend to twist it.
5. One or more forces tend to bend the object.

Structures

Question: Define shear

1. Two forces are applied in the same direction with a tendency to lengthen it.
2. Two opposing forces are applied in the same direction tending to shorten it.
3. Two opposing forces tending to cut it. Correct!!
4. Two opposing forces that tend to twist it.
5. One or more forces tend to bend the object.

Structures.

Structural conditions.

We are going to work these concepts in the workshop area.

Structures.

Artificial structures.

We are going to work these concepts in the workshop area.

Structures.

Structural elements.

We are going to work these concepts in the workshop area.

Structures.

References.

To elaborate this didactic unit, I've used all these materials:

- Photos from the internet.

Please, If there is a photo where it was used without authorization, please send me an email: bernabealvarez@gmail.com

Structures

Questions: All loads are statics?

The universe is immense and it seems to be homogeneous, in a large scale, everywhere we look at.

There's a picture of a galaxy above

Figure: A boat.

`Structures`: All loads are statics.

Solutions:

1. Yes.
2. No.
3. Both are correct.

Structures

Questions: All loads are statics?

The universe is immense and it seems to be homogeneous, in a large scale, everywhere we look at.

There's a picture of a galaxy above

Figure: A boat.

`Structures`: All loads are statics.

Solutions:

1. Yes.
2. No. There are two types of loads: statics and dynamics.
3. Both are correct.

Exercises

Fine adjustement of the watermark position

- `hoffset`
- `voffset`

- `hoffset`
- `voffset`

They admit any *positive* or *negative* spacing unit

Note that some warnings about *badboxes* might be generated at compilation

Esto es difícil...

- Todo aquello capaz de modificar una estática
- slide numbers
- *emph*asized and alerted text

Esto es difícil...

The universe is immense and it seems to be homogeneous, in a large scale, everywhere we look at.