

Mechatronic systems, block diagram, sensors

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February 21, 2022

The instructions

5. Identify **subsystems**, illustrate interaction with a **block-diagram**.
6. Identify **physical variables** that will be necessary to measure in order to monitor and control the process.

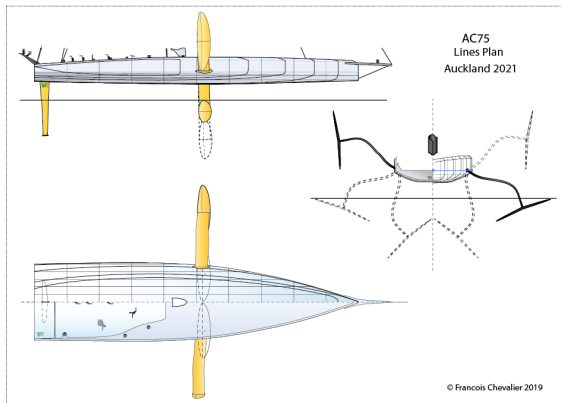
A mechatronic system



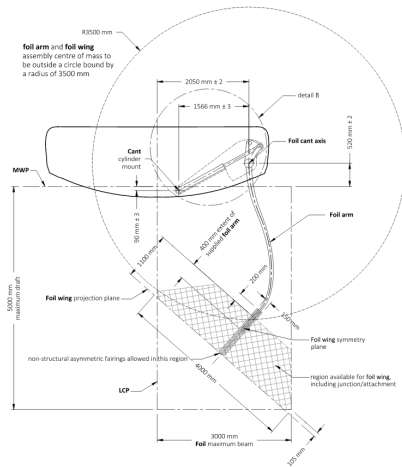
From SailingWorld

AC75 Class

Hydrofoil system

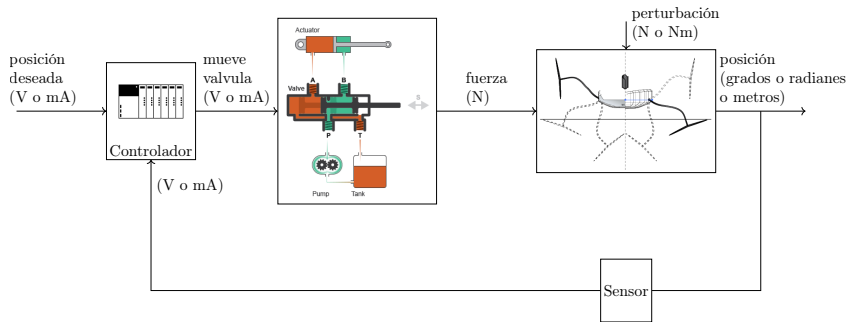


by françois chevalier



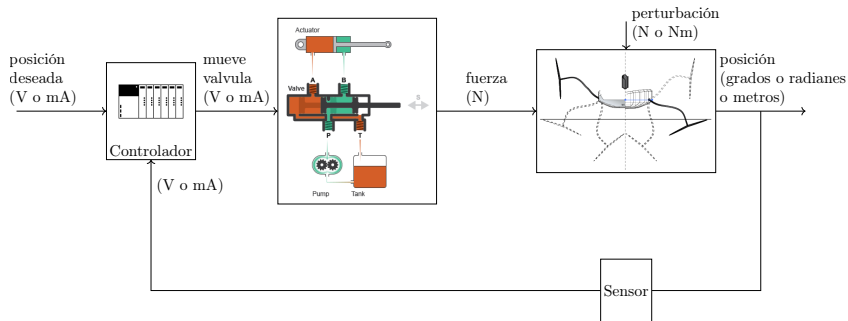
from the ac75 class rule

5. Key components



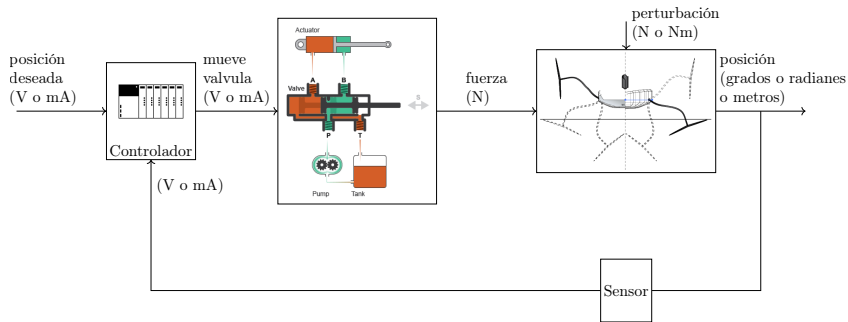
- **Process** or **plant**. Here it is a **mechanical system** or **mechanism**

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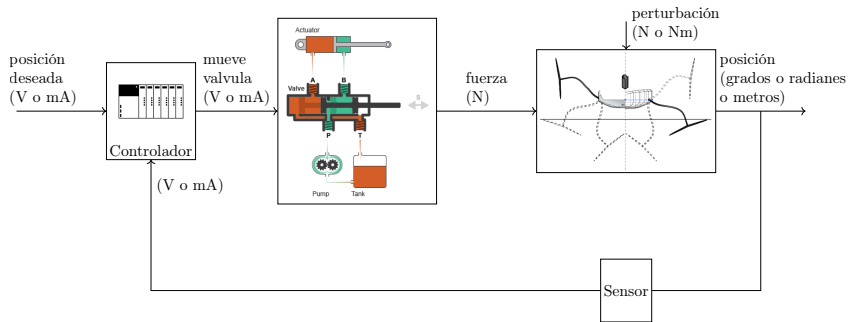
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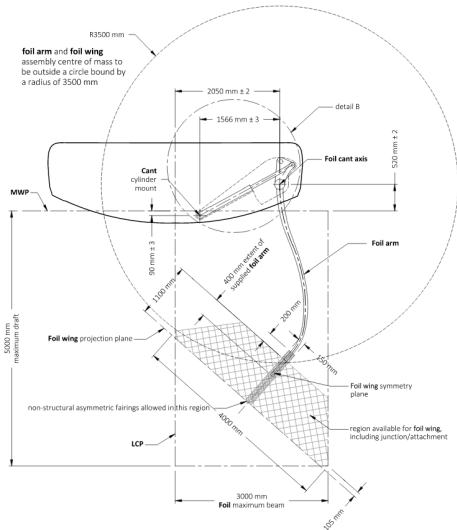
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- **Sensors.** Convert physical variables into signals carrying information.

5. Key components



- ▶ **Process** or **plant**. Here it is a **mechanical system** or **mechanism**
- ▶ **Actuator**. Converts information to force/torque/flow/energy that affect the plant.
- ▶ **Sensors**. Convert physical variables into signals carrying information.
- ▶ **Controller**. Computer or micro-controller or PLC. Receives signals, executes the control algorithm and sends control action to the actuators.

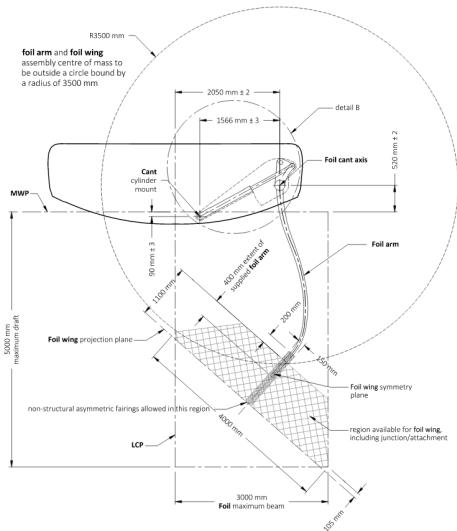
6. Physical variables?



- Displacement (total mass) - 7.6 t
- Mass of each wing - 1.2 t
- Height of the mast - 28m
- Sail area - 235 sqm
- Maximum depth of the wings - 5m

from the ac75 class rule

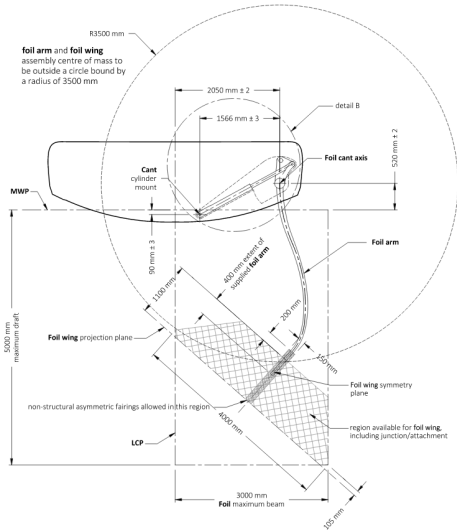
6. Physical variables? No, parameters



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from the ac75 class rule

6. Physical variables



- Position of the pistons (implies the position of the wing)
- Hydraulic pressure
- State-of-charge of the batteries

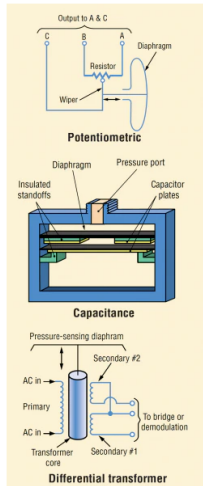
from the ac75 class rule

6. Physical variables

Hydraulic pressure

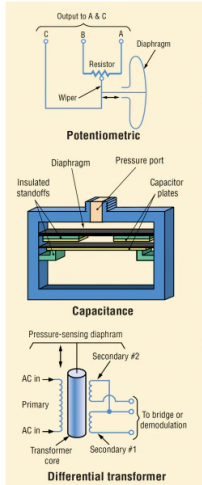
Activity Find three different commercial sensors using three different measurement principles for measuring hydraulic pressure.

Hydraulic pressure

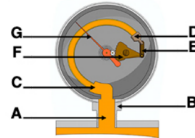


Source: Hydraulics & Pneumatics

Hydraulic pressure



Source: Hydraulics & Pneumatics



MEAS | MEAS M9100

TE Connectivity's (TE) M9100 hydraulic pressure transducer measures fluid pressures up to 700 bar in extreme conditions.

Pressure Transducer Sensor Type: **Industrial Pressure Transducers**
Output/Span: .5 – 4.5 V
Pressure Type: **Gage**
Pressure Accuracy: $\pm 0.25\%$ Span
Pressure Transducer Supply Voltage(V): 4.75 – 5.25



Sources: Tameson, TE Connectivity, Hydac

Displacement

Activity Find three different commercial sensors using three different measurement principles for measuring the displacement of a hydraulic cylinder.

Displacement

Position

- ▶ Draw wire
- ▶ Induction
- ▶ Magnetostriction
- ▶ Flow (volume change)

Displacement

Position

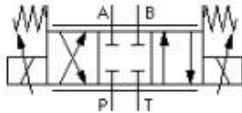
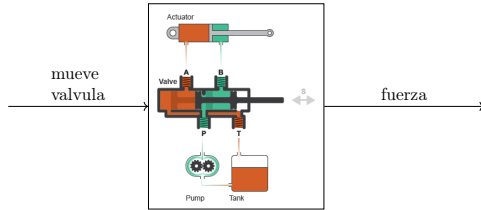
- ▶ Draw wire
- ▶ Induction
- ▶ Magnetostriction
- ▶ Flow (volume change)



Image credit: MTS Systems Corporation

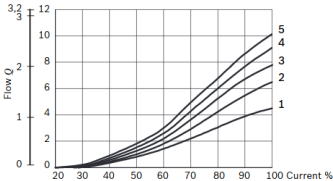
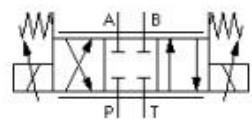
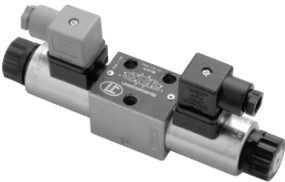
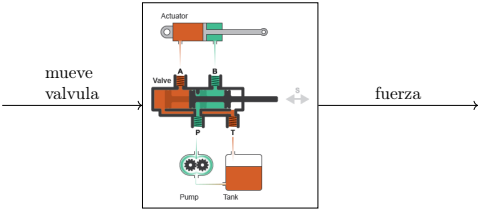
Source: Fischer Christian SIKO GmbH, Linearmotion, MTWmag

5. Actuator



Source: Festo

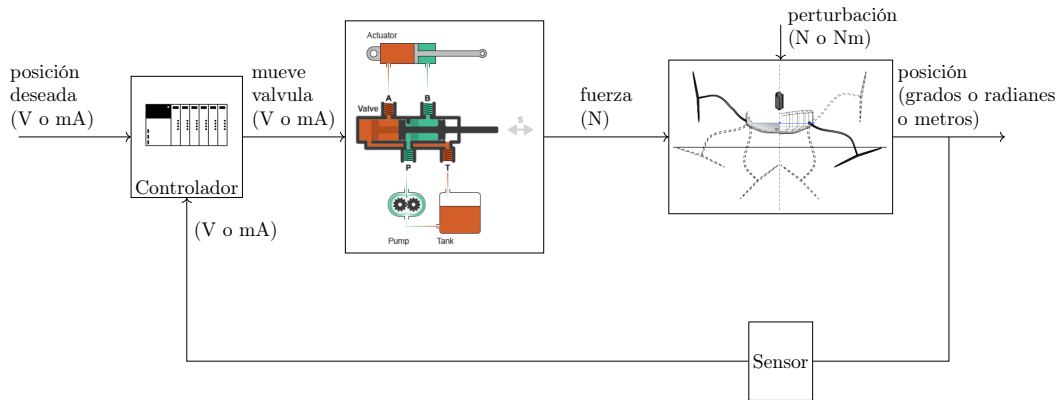
5. Actuator



Sources: Bosch Rexroth

Source: Festo

5. Block-diagram - basic



... and more elaborate

