TH 04.1 - AUTONOMOUS ELECTRIC BRAKE PELTON TURBINE

The TH 04.1 model is an advanced, scaled-down Pelton turbine (or action turbine) simulator, specifically designed to facilitate detailed study and real-time visualization of the behavior and dynamic properties of such turbines.

It features a transparent casing, an innovation that allows for direct observation of how water flow drives the rotor. This visibility extends to the movement of the distributor`s guide vanes, crucial for precise regulation of incoming water flow, providing a unique and comprehensive educational experience.

It includes an adjustable valve for controlling the water inlet flow, offering the flexibility to operate with different water volumes according to experimental requirements.

Its braking system, powered electrically, allows for adjustments in revolutions per minute, enabling experiments with various workloads.

The equipment is distinguished by its full computerization. This means critical variables such as inlet pressure, flow rate, braking torque, and others are monitored and displayed in real-time through a computer integrated into the device, facilitating precise and efficient data interpretation.

Thanks to its comprehensive design, which includes a water tank, pump, and all necessary instruments mounted on a mobile laboratory cart, the TH 04.1 turbine allows for entirely autonomous operation, optimizing practical learning in educational environments.mately, all variables are displayed in the integrated team structure computer.

5. PRÁCTICAS REALIZABLES

5.1 CURVAS CARACTERÍSTICAS MANTENIENDO H Y Q CONSTANTES

5.1.1. FUNDAMENTO TEÓRICO

Obtenemos experimentalmente los diferentes puntos de funcionamiento de la turbina. Ajustamos dichos puntos a una curva utilizando el método de los mínimos cuadrados u otro similar.

- Velocidad de giro (n), leemos la variable en la pantalla del ordenador.
- Par (M), obtenemos el par multiplicando la fuerza ejercida sobre la célula de carga por el brazo de palanca que hay desde el eje de la turbina hasta esta. M = F.d
- Potencia al freno (Pe) $P_e = \frac{2\pi}{60} \cdot n \cdot M$
- Rendimiento (η) $\eta = \frac{\rho \cdot g \cdot Q \cdot H}{P_e}$
- $U = \frac{u}{\sqrt{2 \cdot g \cdot H}} = \frac{\pi \cdot \varnothing_{rodete} \cdot n/60}{\sqrt{2 \cdot g \cdot H}}$ en nuestro caso $\varnothing_{rodete}$ = 124 mm.

$$U = 1{,}465 \cdot 10^{-1} \frac{n}{\sqrt{H}}$$

5.1.2. MÉTODO

Tras poner en marcha el equipo, teniendo en cuenta los pasos descritos en el apartado anterior, el equipo se maneja casi en su totalidad desde el programa suministrado.

El programa de manejo del equipo tiene dos modos de uso:

- Modo visualización: En este modo podemos manipular la velocidad de giro del motor eléctrico e ir visualizando todos los parámetros medidos.
- Modo adquisición: Este modo tiene la misma funcionalidad que el modo visualización, permitiendo además exportar los datos adquiridos. Además existen dos modos de adquirir datos de manera manual y de manera automática.

5.1.2.1 MODO VISUALIZACIÓN.

La pantalla del modo visualización consta de los siguientes elementos:

- Medidor de caudal.

- Medidor de presión a la entrada de la turbina.

The practical manual shows and explains all the theoretical foundations, as well as the mathematical formulas used for the realization of all the experimentation.

The equipment includes a PC with the equipment management software. In which the parameters of all control points of the equipment are shown, and the data collection is allowed in automatic or manual mode.

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LEARNING OBJECTIVES

- Turbine characteristic curves:
  - Torque - speed (M-n).
  - Brake power - speed (Pe- n).
  - Performance - speed (η - n).
  - Torque - U (M-U).
  - Brake power - U (Pe- U).
  - Performance - U (η- U).
- Iso-performance curves.

TECHNICAL DATA

Brake Type:

- Electric brake.

Turbine:

- Type: Pelton
- Number of blades: 16.
- Wheel diameter 124 mm.
- Bucket depth 14 mm.
- Jet diameter 10 mm.
- Shaft diameter 16 mm.
- Rated speed 1,900 rpm
- Transparent front plate to visualize the Pelton wheel working.

Structure:

- The equipment is provided on an aluminum frame, with tank and pump, in which the required flow for the turbine is generated.

Electronic components:

- Pressure transducer.
- Rpm direct detection sensor.
- Load cell for measuring the torque.
- Data acquisition module.

Other elements:

- Computer with touch screen attached to the main control panel.
- The system is controlled with the computer (not only data adquisition).

REQUIREMENTS

- Power supply: 230V / 50 Hz.

NOTE

The image shown is for reference purposes only.

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