

* electrical systems

فيها يتم تحويل الطاقة الكهربائية إلى mechanical work
 عند electromechanical device: إدخال إشارة كهربائية فتتحول
 إلى حركة "دورانيات أو خطية ... etc"

* Hydraulic system

فيها يتم تحويل ضغط السوائل إلى mechanical work
 توضيح: - فإذا النظام كان في البداية الإغمار على مياه ولكن نتج
 عن ذلك بعض العيوب، فتم اللجوء إلى استخدام الزيت.

* pneumatic system "neumatic system"

فيها يتم تحويل ضغط الغازات إلى mechanical work "خطية"
 ، دورانيات ... etc

* electroHydraulic

* electroNeumatic

الإشارة الكهربائية ليس لها علاقة بال power ولكنها لها
 علاقة بالنظام من خلال Control unit

غاز
 سائل
 Fluid



* يتم التحكم في الـ Fluid عن طريق الـ Valve التي يتحكم فيها النظام
الـ Hydraulic motor.

* manual valve

فيتم تغير مقدار الغاز أو المياه يدوياً

* Solenoid valve

يتم التحكم في الـ Valve عن طريق الإشارة الكهربائية

* الـ Valve يتحكم في مقدار الزيت الذي يدخل إلى المضخة ومن ثم

التحكم في سرعة الـ Hydraulic motor. لذلك يتم التحكم

فيه من خلال الإشارة الكهربائية المرسلة من الـ Central unit.

ملحوظة:

* في الـ DC polarity لهاتين الـ Hydraulic ports 1, 2

يعني لو دخلت الزيت في الإنباط من Port 1 إلى Port 2 ده إنباط

ولو عكست إنباط الزيت في الإنباط من Port 2 إلى Port 1 ده

الإنباط العكس. وبالتالي يتحكم إنباط الـ Hydraulic motor

* الـ Valve مستخدم للتحكم في سرعة الـ motor وإنباط الـ

* (ملاحظة)



* In the industry we use three methods for transmitting power from one point to another.

1- Mechanical transmission is through shafts, gears, chains, belts.

2- Electrical transmission is through wires, transformers

3- Fluid power is through liquids or gas in a confined space.

* Fluid power is the technology that deals with the generation, control and transmission of forces and movement of mechanical element or system with the use of pressurized fluids in a confined system.

mechanical work (العمل الميكانيكي)

* Both liquids and gases are considered fluids

* Fluid power system includes :-

- a hydraulic system "hydra meaning water in Greek"
and a pneumatic system "pneuma meaning air in Greek"

* Oil hydraulic employs pressurized liquid petroleum oils and synthetic oils.

مثلاً لا يوجد بها مواد كيميائية وتلك السوائل
ولذلك لا تعمل على التزييت أو التشحيم فتكون حركاتها سبب
الشح وبالتالي يبوط سطح المكابس . والمواد الكيميائية
تؤثر على الموصلات . لذلك بدأوا بالاستعانة بالزيت بدلاً عنها

* pneumatic employs Compressed air that is released to the atmosphere after performing the work.

* Water has Certain drawbacks in the transmission of hydraulic power in machine operation and Control.

* Commercially, pure water Contains various chemical and also foreign matter, and unless special precautions are taken it is used.

* it is nearly impossible to maintain valves and working surfaces in satisfactory Condition.

* Fluid power applications can be classified into two major segments:-

1. Stationary hydraulics.
2. Mobile hydraulics.

* Stationary hydraulics:-

stationary hydraulic systems remain firmly fixed in one position.

Stationary hydraulic systems are used in a wide range of applications, including industrial machinery, power generation, and transportation.

The characteristics feature of stationary hydraulic is that valves are mainly Solenoid operated. closed loop Control

The application of stationary hydraulics are:-

1. Machine tools and transfer lines.
2. Lifting and Conveying devices.
3. Metal-forming pressure.
4. plastic machinery such as injection-molding machines.

* 5. Rolling machines

6. Lifts

7. Food processing machinery.

8. Automatic handling equipment and robots.

* Mobile hydraulic systems:-

- move on wheels or tracks such as a tower crane or excavator truck to operate in many different locations or while moving.

- A characteristic feature of mobile hydraulics is that the valves are frequently manually operated.

الاجزاء يتنقل مكانها لتخدم تاراجيب (زي) التولاش
رفع الاعمال دائماً ياور manual و uncontrolled.

* The applications of mobile hydraulics are as follows:-

1. Automobiles, tractors, aeroplanes, missile, boats

2. Construction machinery.



* 3. Tipper, excavators and elevating platforms.

4. Lifting and Conveying devices

5. Agricultural machinery.

* The following are the two types of hydraulic systems:-

1. Fluid transport systems.

2. Fluid power systems.

Fluid transport systems: Their sole objective is the delivery of a fluid from one location to another to accomplish some useful purpose.

Examples include pumping stations for pumping water to homes, Cross Country gas lines, etc.

نقل السائل (Fluid) من نقطة إلى نقطة أخرى (Control)

مثال: محطات ضخ المياه، خطوط الغاز، إلخ.

W. G. X



* Fluid power systems: These are designed to perform work. In fluid power systems, work is obtained by pressurized fluid acting directly on a fluid cylinder or a fluid motor.

- A cylinder produces a force resulting in linear motion, whereas a fluid motor produces a torque resulting in rotary motion.

نظام التحكم في الحلقة المغلقة Hydraulic closed loop system
نظام التحكم في الموضع Position Control

* The Fluid power system can be categorized as,

1. Based on the Control system,
2. Based on the type of Control.

Based on the Control system:-

1. Open-Loop system:

There is no feedback in the open system and performance is based on the characteristics of the individual components of the system. -8-

* The open-loop system is not accurate and error can be reduced by proper Calibration and Control.

منشأ العلاقة بين الخرج والداخل والتحكم في ذلك
operator

2. Closed-Loop system:

This system uses feedback. The output of the system is fed back to a Comparator by a measuring element.

The Comparator compares the actual output to the desired output and gives an error signal to the Control element.

The error is used to change the actual output and bring it closer to the desired value.

A simple closed-loop system uses servo valves and an advanced system uses digital electronics.

U-G-D-X



* Based on the Type of Control

1. Fluid Logic Control: This type of system is controlled by hydraulic oil or air. The system employs fluid logic devices such as AND, OR, NOR, NAND,

AND و OR مع صمامات الهيدروليك Hydraulic valves

OR:- Fluid 2 valves (in series) motor

AND:- 2 valves (in series) motor

2. Electrical Control: This type of system is controlled by electrical devices. Four basic electrical devices are used for controlling the fluid power systems: switches, relays, timers and solenoids

Switches و Control Interface programmable

* 3- Electronic Control: This type of system is controlled by microelectronic devices.

The electronic brain is used to control the fluid power muscles for doing work.

This system uses the most advanced type of electronic hardware including programmable logic control "PLC" or microprocessor (μP).

نائب برنامج على الكمبيوتر واجهة بين النظام و الكمبيوتر .

* Advantages of Hydraulics :

- 1- Fluid power systems are simply, easy to operate and can be controlled accurately.
- 2- Multiplication and variation of forces.
- 3- Multifunction Control
- 4- Low-speed torque



* 5. Constant force or torque.

6. Economical

7. Low weight to power ratio

8. Fluid power systems can be used where safety is of vital importance.

أقدر الحصول على قدرة عالية جداً عن طريق جهاز صغير.

× ما التشابك بين دائرة الـ Hydraulic والدائرة الكهربائية؟

الـ pressure input يمثل قوة المحرك الموجودة في الدائرة الكهربائية

التيار الكهربائي في الدائرة الكهربائية يمثل الـ "Flow" معدل التدفق

× Safety protection Hydraulic sys ومع
→ Safety pump

في حالة انشطار الواسير

← pressure regulator
يحبب الضغط في قوتنا

الـ Filter في نظام الـ Hydraulic يعمل على تنقية الزيت
من أي شوائب.

XX - GAX



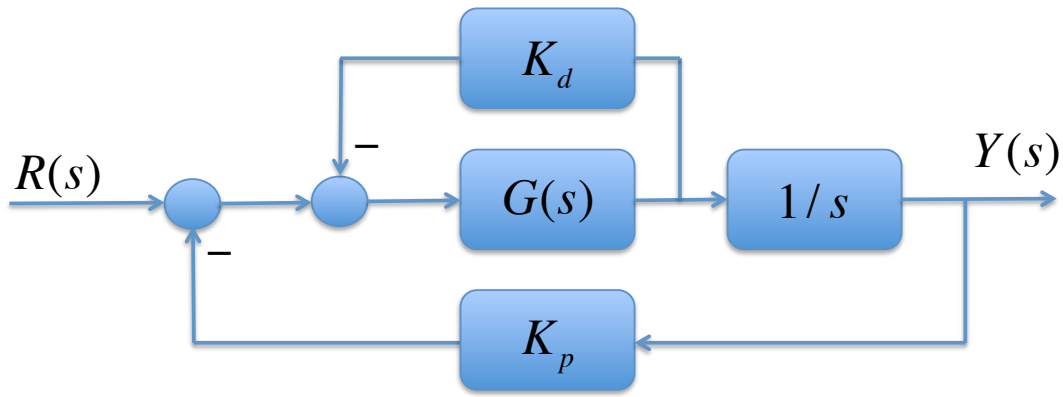


Figure 1: Block diagram of basic servomechanism-based regulator.

2 Description

The electro-hydraulic system used in this experiments is the EHS160 (FEEDBACK INSTRUMENTS LTD). It consists of the following hydraulic components: the hydraulic pump which delivers hydraulic energy, the servo system (Figures 2 and 3). The servo system consists of a servo-valve, hydraulic ducts, hydro-motor and the sensors for angular velocity and angle. A PC will be used instead of the existing controller components.

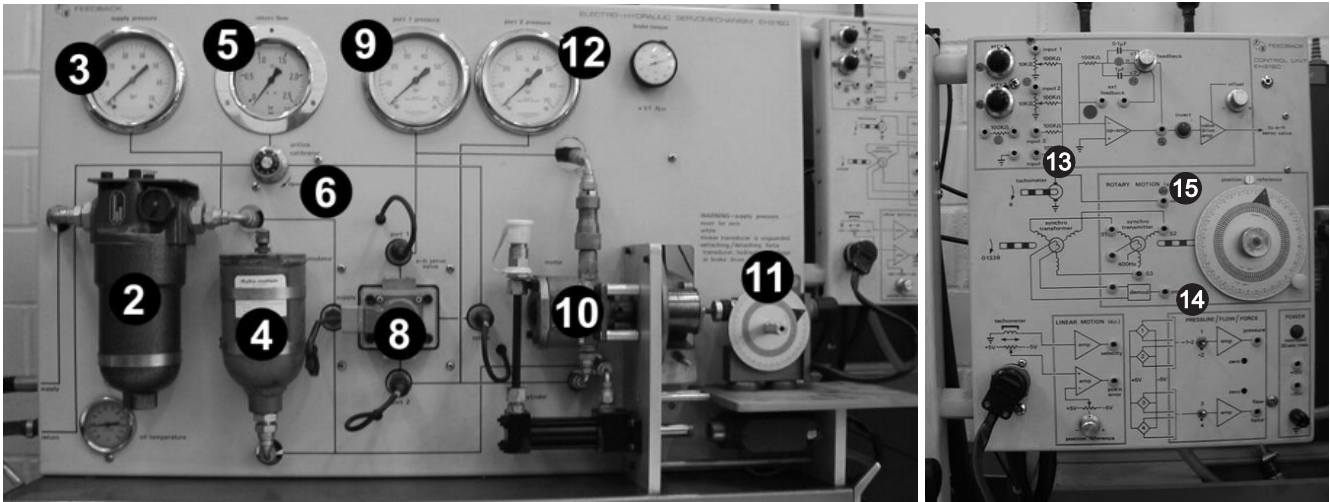


Figure 2: Feedback, Inc. hydraulic servomechanism.

List of components:

1. Pump
2. Filter
3. Indicator: Supply pressure
4. Accumulator tank
5. Indicator: volumetric flow in the return line

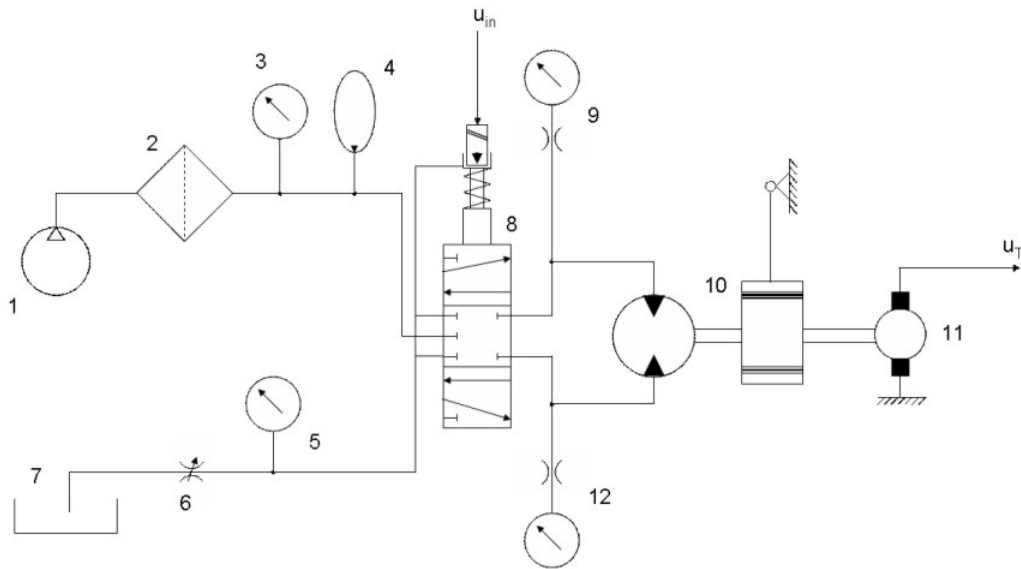


Figure 3: Feedback, Inc. hydraulic servomechanism.

6. Adjustable throttle valve
7. Reservoir
8. Servo valve
9. Indicator: Pressure of servovalves output 1
10. Hydromotor
11. Tachometer
12. Indicator: Pressure of servovalves output 2
13. Input (Input 4 (u_{in} in Figure 3))
14. Output (position error)
15. Output (velocity (u_T in Figure 3))

An electric driven hydraulic pump (1) transports the oil from the reservoir (7) through a flexible pressure tubing to the pressure side of the servo-valves (8). The supply pressure in the power unit (measured by (3)) will be held at a constant value by a pressure relief valve. The outputs of the servo-valve control the hydromotor (10) through two hydraulic tubes. The hydromotor transforms the hydraulic pressure or a hydraulic oil flow into a moment or angular velocity. Another engine or a load can be driven by the drive shaft of the hydro-motor. A flywheel mass on the driving shaft of the hydromotor can be braked by a shoe brake (not installed). A following tachometer (11) changes the angular speed into a voltage proportionally to the angular speed. The position error voltage (14) or the speed voltage (15) are the inputs to the PC. The controller will be realized by LABVIEW. The controller sends out a voltage to the servo-valve (8) as a control signal (13) depending on the control error (the difference between reference value and measured value). Oil flows out of the servo system, through the servo-valve and return line, and back to the reservoir (7). Electro-hydraulic systems show both the advantages of the electrical and the hydraulic system (high response speed, large power and reliability).