

			1
	<h1>Actuators</h1> <p>Daniel Kohn University of Memphis TECH 3821 Fall 2017</p>		

---

---

---

---

---

---

---

---

		Actuators	2								
	<p>Actuator - a servomechanism that supplies and transmits a measured amount of energy for the operation of another mechanism or system.</p> <table><tr><td><u>Categories</u></td><td><u>Types</u></td></tr><tr><td>Valves</td><td>Electro-Magnetic</td></tr><tr><td>Motors</td><td>Pneumatic</td></tr><tr><td>Linear Actuators</td><td>Hydraulic</td></tr></table>			<u>Categories</u>	<u>Types</u>	Valves	Electro-Magnetic	Motors	Pneumatic	Linear Actuators	Hydraulic
<u>Categories</u>	<u>Types</u>										
Valves	Electro-Magnetic										
Motors	Pneumatic										
Linear Actuators	Hydraulic										

---

---

---

---

---

---

---

---

			3
	<h1>Valves</h1>		

---

---

---

---

---

---

---

---

4

- Valves – Sliding-stem Valves

Single-port globe valve, Double-port globe valve, Gate valve, Diaphragm valve

---

---

---

---

---

---

---

---

5

- Valves – Rotary-stem valves

Ball valve, Butterfly valve, Dark valve

---

---

---

---

---

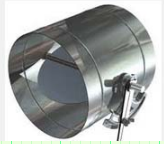

---

---

---

6

- Dampers and Louvers - a multi-element flow control device generally used to throttle large flows of air at low pressure

---

---

---

---

---


---

---

---

7

- Manual Valves



---

---

---

---

---


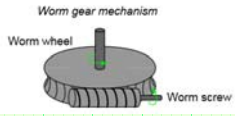
---

---

---

8

- Valve Actuation – Electro/Mechanical



---

---

---

---

---

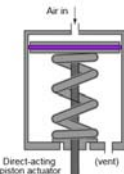
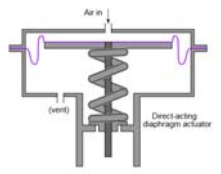

---

---

---

9

- Pneumatic Actuators



---

---

---

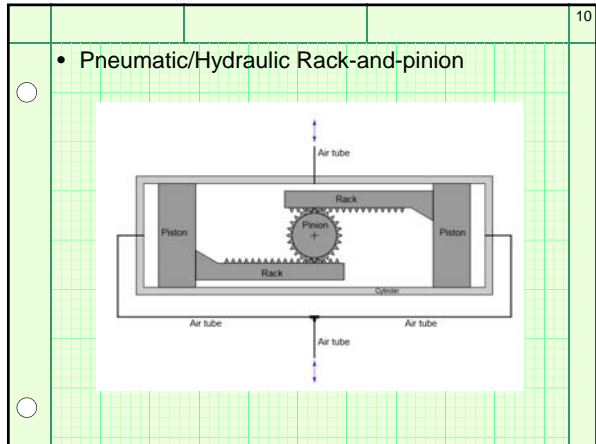
---

---

---

---

---



---

---

---

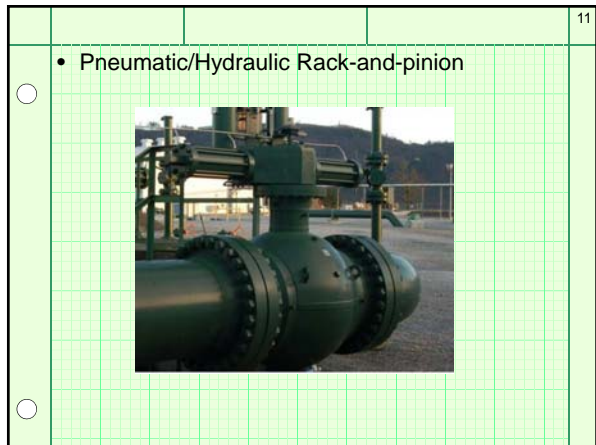
---

---

---

---

---



---

---

---

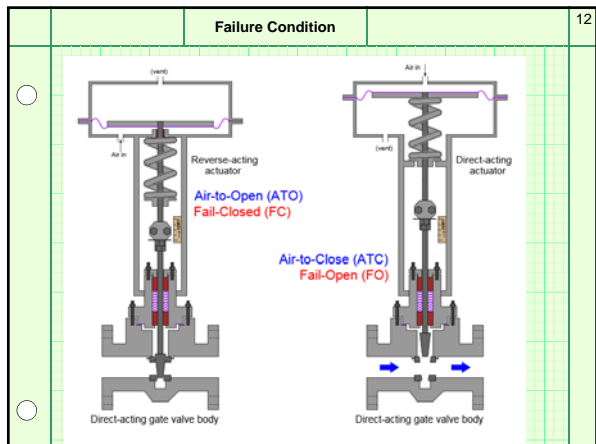
---

---

---

---

---



---

---

---

---

---

---

---

---

13

• Piping Diagram symbols

<p>Fail open FO</p>	<p>Fail closed FC</p>
<p>Fail locked FL</p>	<p>Fail indeterminate</p>
<p>Fail last/drift open FL/DO</p>	<p>Fail last/drift closed FL/DC</p>

---

---

---

---

---

---

---

---

14

• Piping / Control Diagrams

---

---

---

---

---

---

---

---

15

• Actuator Response

---

---

---

---

---

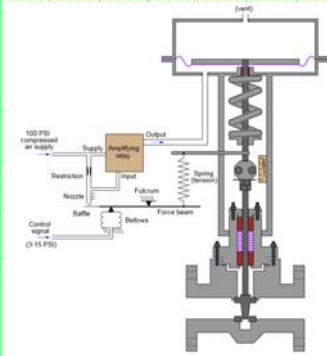
---

---

---

16

• Pneumatic Positions



---

---

---

---

---

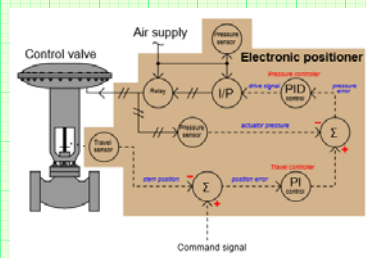
---

---

---

17

• Electronic Positioners (Air Driven)



---

---

---

---

---

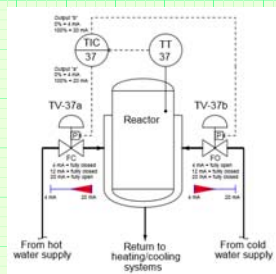
---

---

---

18

• Split-Ranging



---

---

---

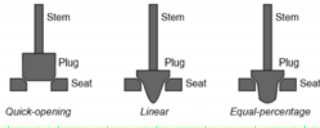
---

---

---

---

---

			19
○	<p>• Valve Trim Shapes</p> <div style="text-align: center;">  </div>		
○			

---

---

---

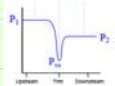
---

---

---

---

---

			20
○	<p><b>Control Valve Issues</b></p> <ul style="list-style-type: none"> <li>• Mechanical Friction</li> <li>• Flashing - a fluid passes through the constrictive passageways of a control valve, its average velocity increase</li> </ul> <div style="text-align: center;">  </div> <ul style="list-style-type: none"> <li>• Cavitation - vapor will re-condense back into liquid again</li> <li>• Choked flow - rate of flow through a valve does not change substantially as downstream pressure is reduced</li> </ul>		
○			

---

---

---


---

---

---

---

---

			21
○	<p><b>Control Valve Issues</b></p> <ul style="list-style-type: none"> <li>• Valve Noise - audible noise produced by turbulence as the fluid moves through a control valve</li> <li>• Erosion</li> </ul> <div style="text-align: center;">  </div> <ul style="list-style-type: none"> <li>• Chemical attack</li> <li>• Stiction and Backlash</li> </ul>		
○			

---

---

---

---

---

---

---

---

22

# Motors

---

---

---

---

---

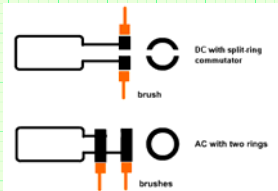
---

---

---

23

- Slip Ring vs Commutator



The diagram shows two electrical connections. The top one is labeled 'DC with split ring commutator' and shows a single split ring connected to a brush. The bottom one is labeled 'AC with two rings' and shows two separate rings connected to two brushes.

---

---

---

---

---

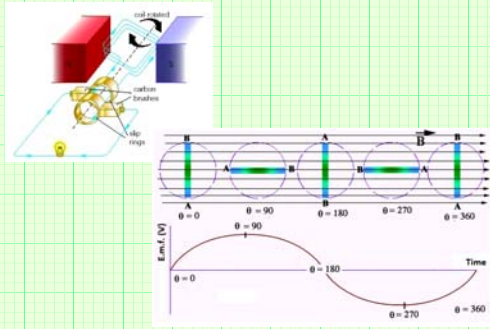
---

---

---

24

- AC Slip Ring



The diagram illustrates an AC slip ring motor with labels for the rotor, slip rings, and brushes. Below it is a graph showing the induced EMF (E<sub>ind</sub> [V]) over time. The graph features a sine wave with peaks at  $\theta = 0$  and  $\theta = 360$ , and troughs at  $\theta = 180$ . The x-axis is labeled 'Time' and the y-axis is labeled 'E<sub>ind</sub> [V]'. The graph also shows the rotor's position at various angles:  $\theta = 0, 90, 180, 270, 360$ .

---

---

---

---

---

---

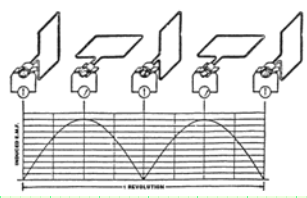
---

---



25

- DC - Commutator



The diagram illustrates the operation of a DC commutator. It shows a series of brushes and commutator segments. Below the brushes, a graph plots current over one full revolution. The current starts at a positive value, drops to zero at the brush transition, and then rises to a positive value again, demonstrating the rectification of AC into DC.

---

---

---

---

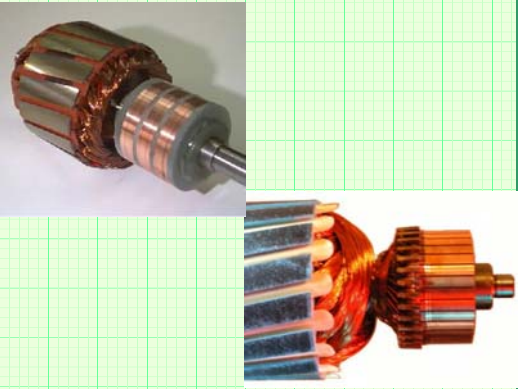
---

---

---

---

26



The photograph shows a disassembled DC motor armature assembly. On the left, the armature is mounted on a shaft with a commutator. On the right, the armature is shown without the shaft, revealing the copper windings and the commutator segments.

---

---

---

---

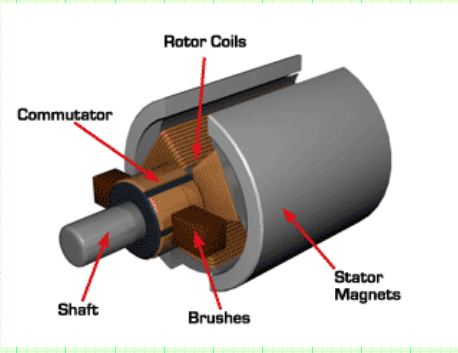
---

---

---

---

27



A 3D cutaway diagram of a DC motor. The components are labeled as follows: Rotor Coils (the winding on the central shaft), Commutator (the ring of segments on the shaft), Shaft (the central axis), Brushes (the contact points on the commutator), and Stator Magnets (the permanent magnets surrounding the rotor).

---

---

---

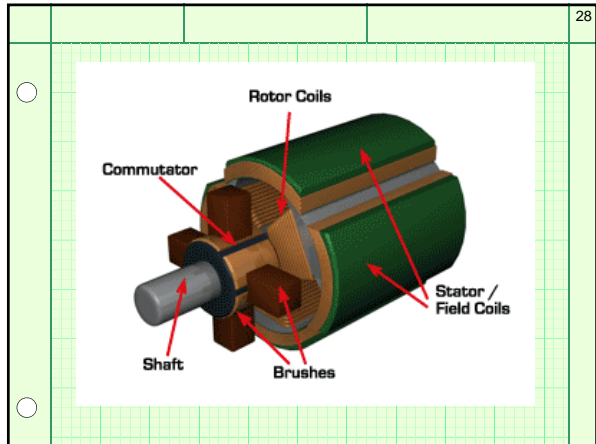
---

---

---

---

---



---

---

---

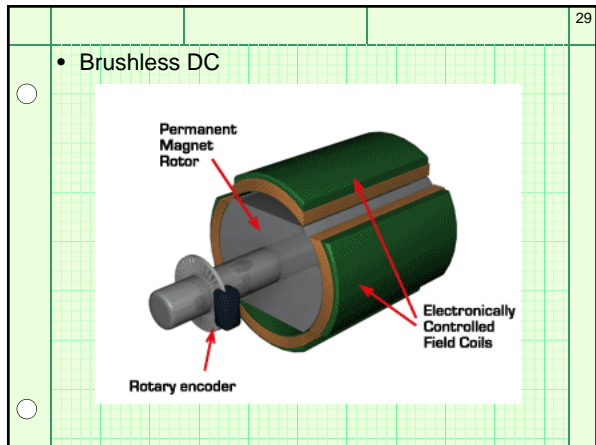
---

---

---

---

---



---

---

---

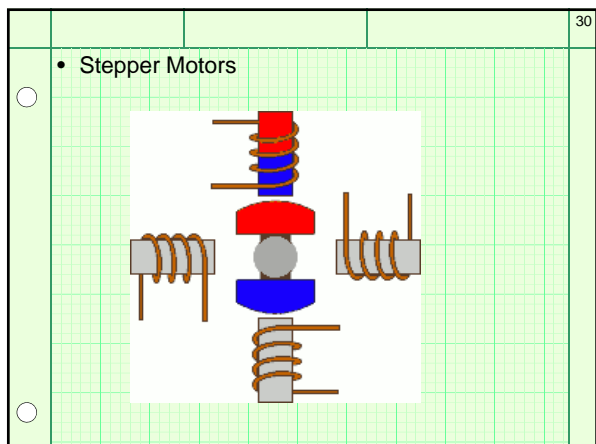
---

---

---

---

---



---

---

---

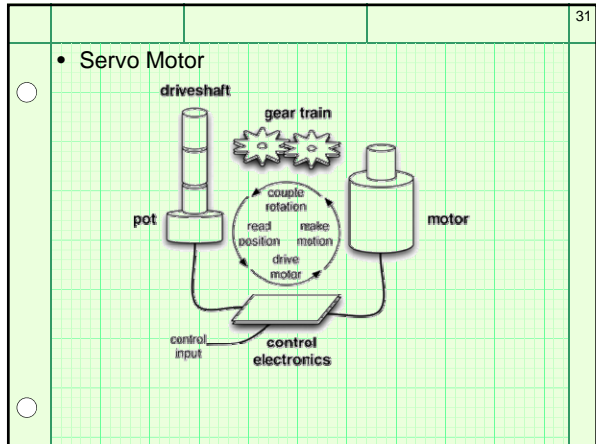
---

---

---

---

---



---

---

---

---

---

---

---

---

32

# Solenoids

---

---

---

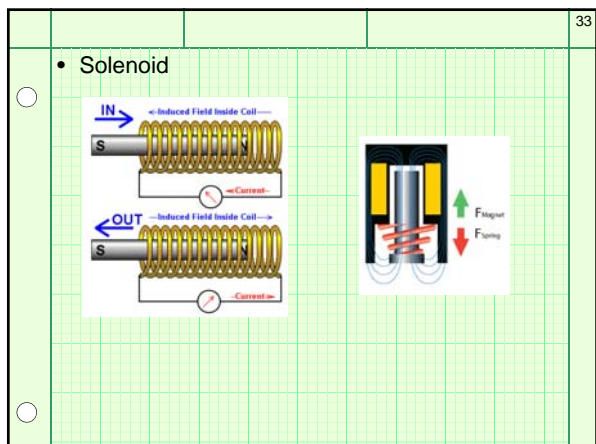
---

---

---

---

---



---

---

---

---

---

---

---

---