

Window of Nano-Motion in Electronic Engineering Applications

By
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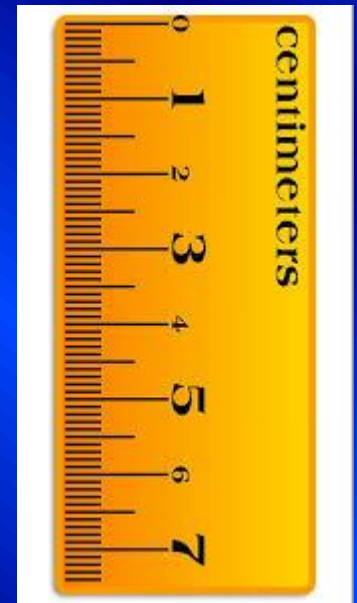
Nano Meter

1- Resolution:

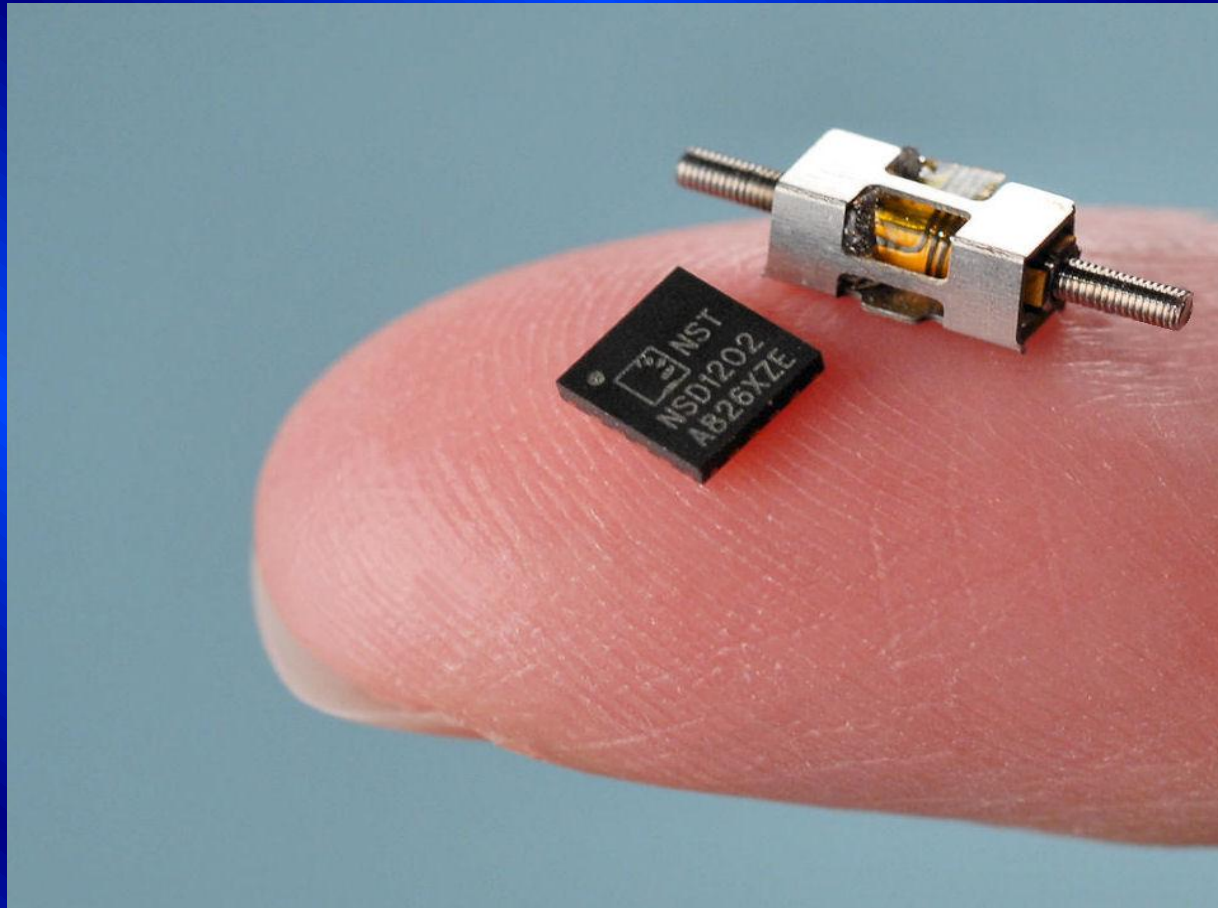
≥ 1 Nanometer

1mm = 1/1000 micro

1nm = 1×10^{-9} m



Nano-meter Electronic Engine

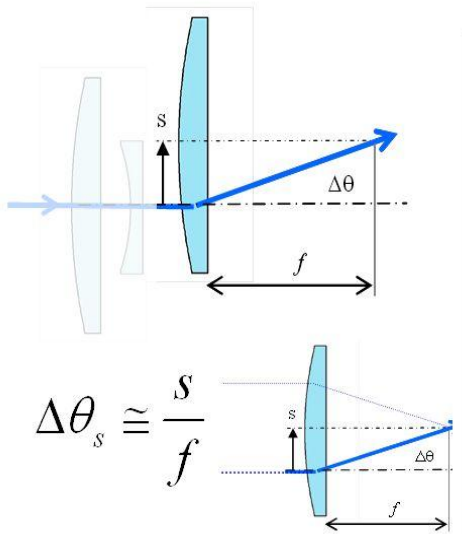


Nano-Motion of Camera lens

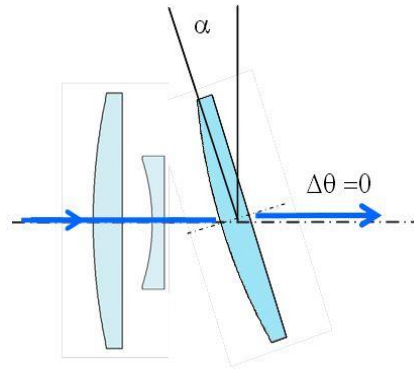
THE UNIVERSITY OF
ARIZONA
TUCSON ARIZONA

Lens motion

decenter

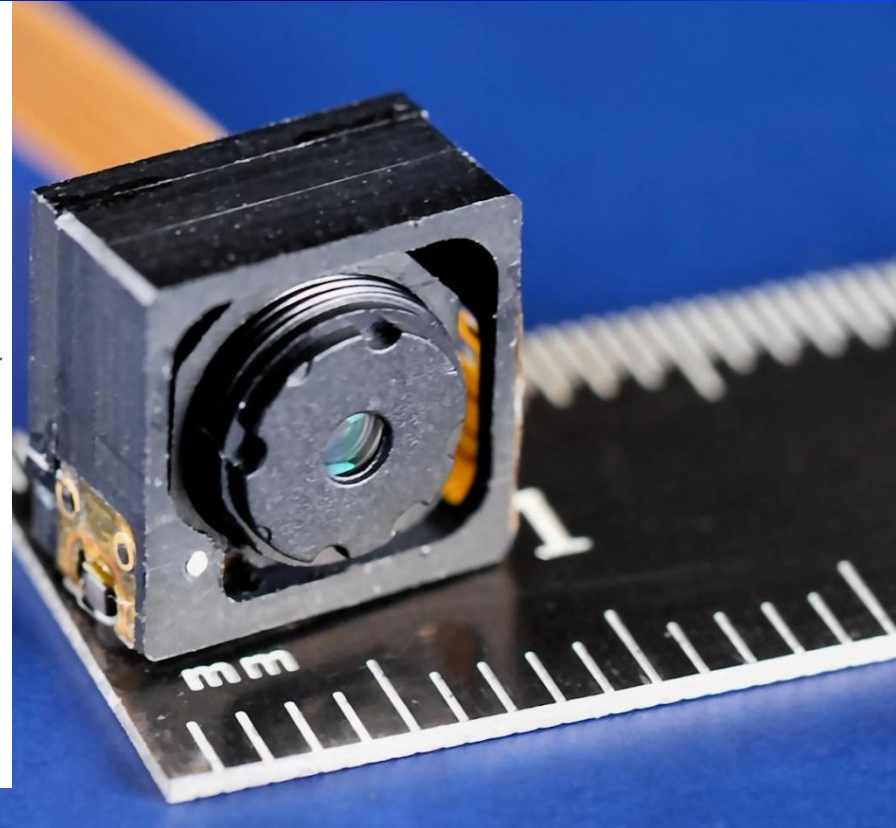


tilt



(Very small effect)

J. H. Burge

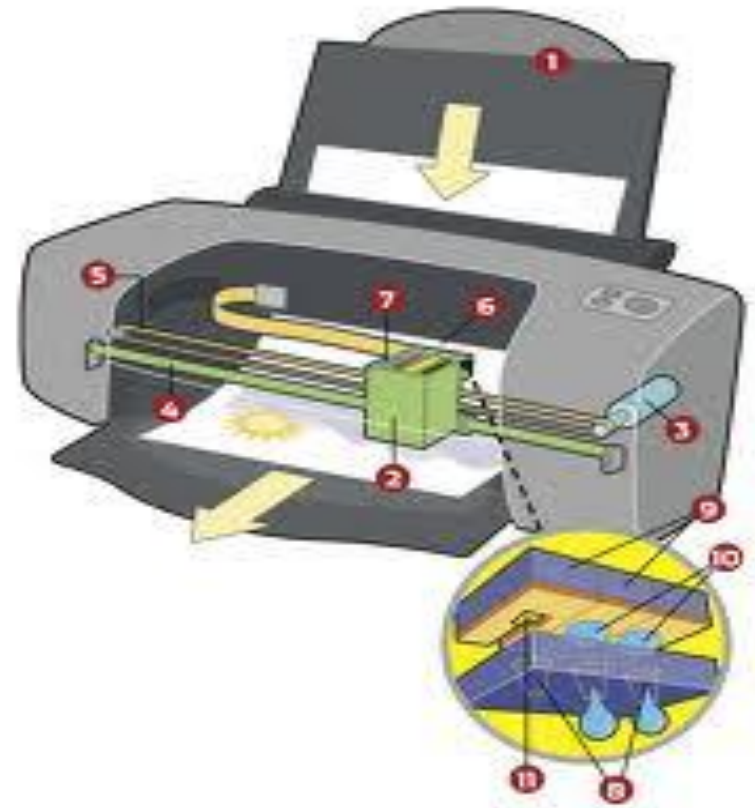


Telescope Nano Motion

Distance between Earth and Jupiter is 588 million Km



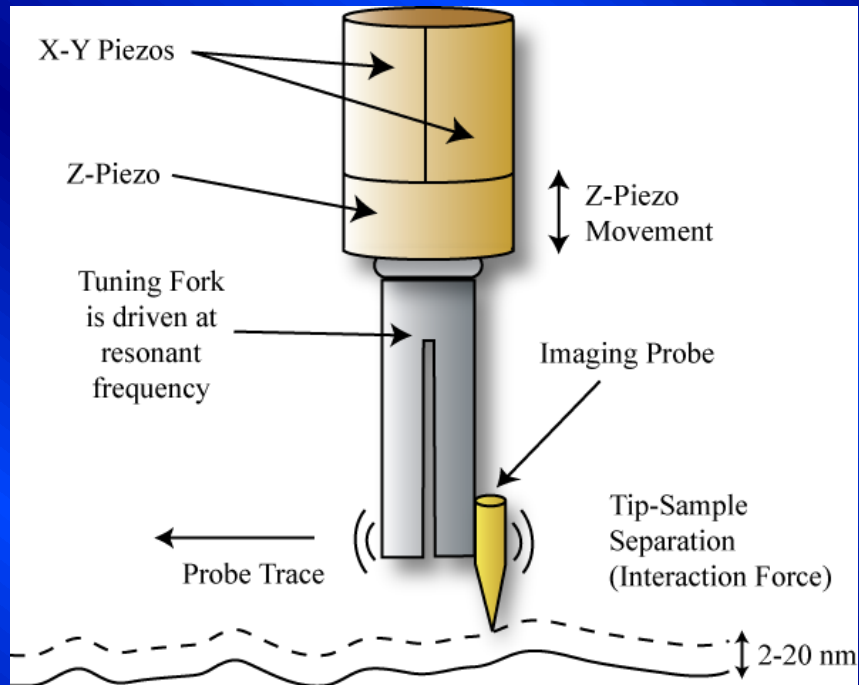
High Accuracy Printer



Nano Motion of Robot Surgery

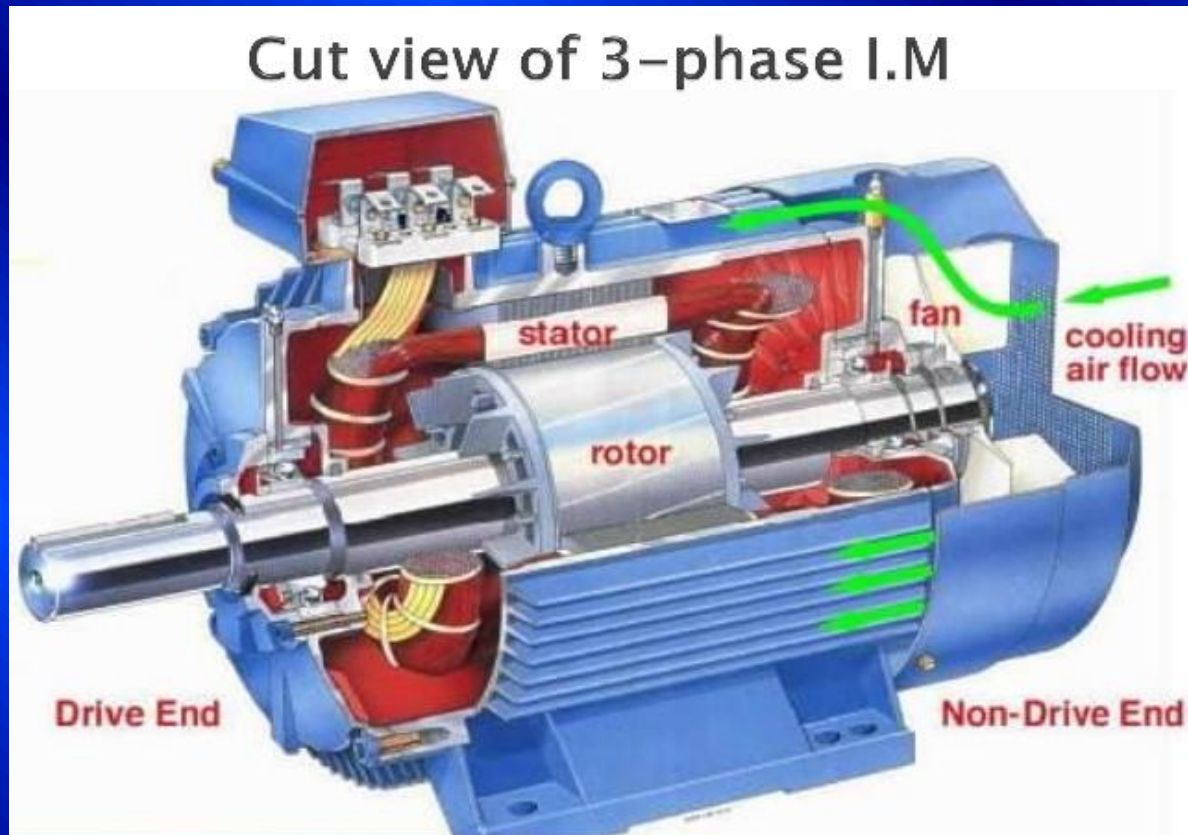


Microscope Nano-movement



Classic Sources of Engineering Motion

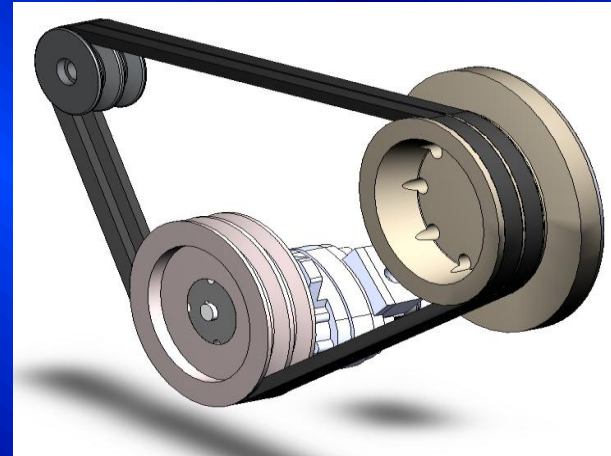
1- Electric Motor



2- Mechanical Engine

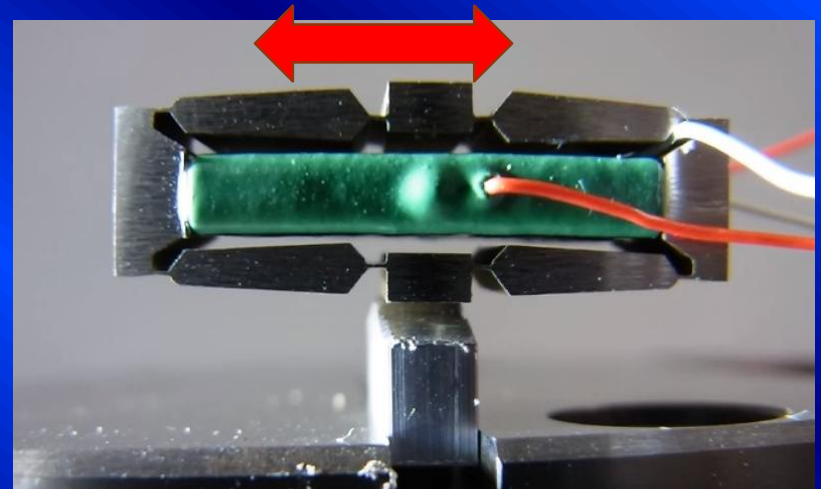
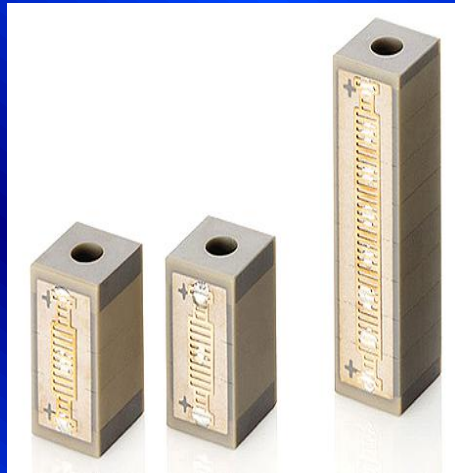


Reduction of Speed





Piezoelectric Actuators



Nano-Movement

- 1- Very small
- 2- High Accurate
- 3- Controlled movement
- 4- Wide rang of speed
- 5- No Friction
- 6- No Noise

2- Speed:

Fastest 300mm/sec

Slowest 1 micron/ sec



3-Thrust Dynamic

- 1 Motor Element



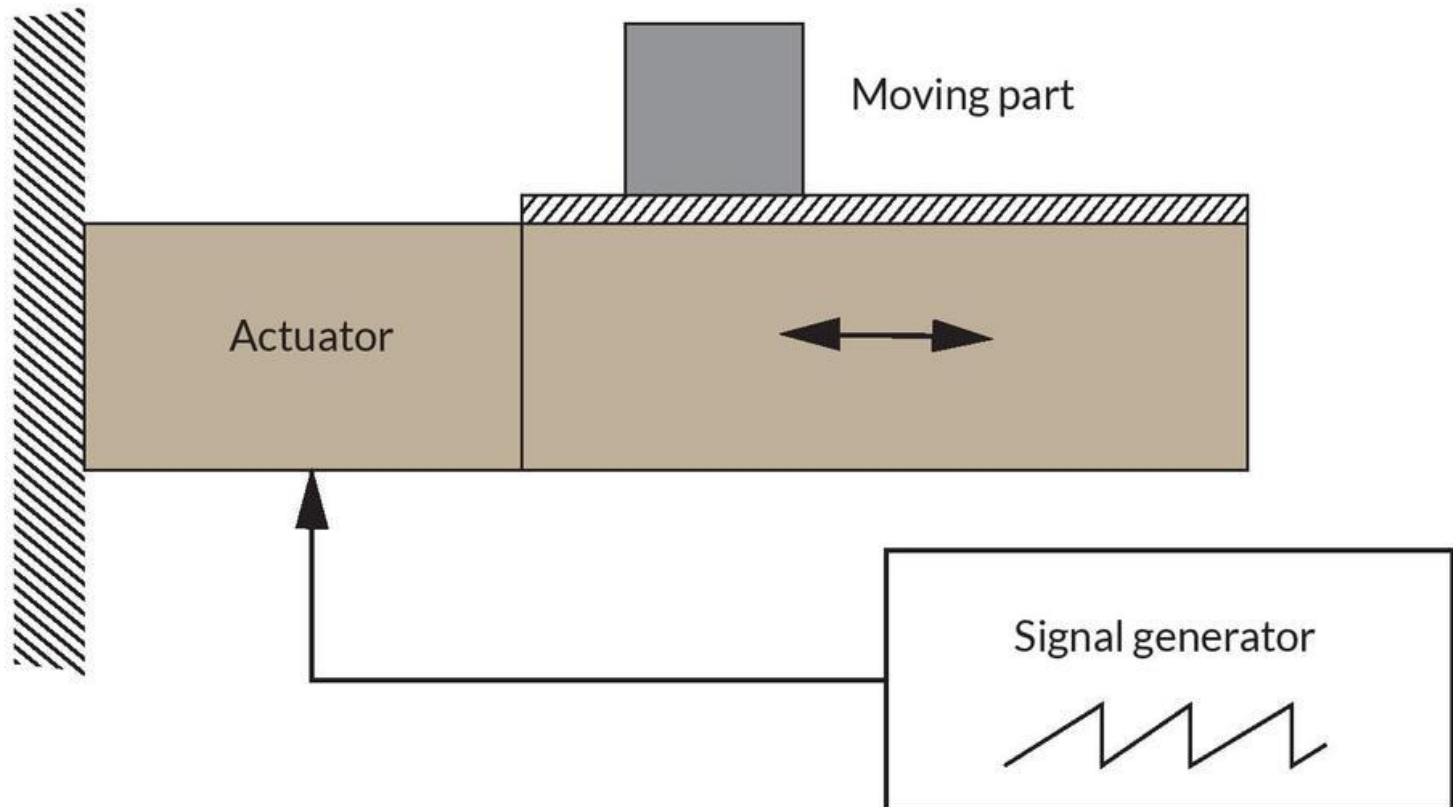
- Approximation 1 Lb thrust
- 4.44 Newton

3- Life

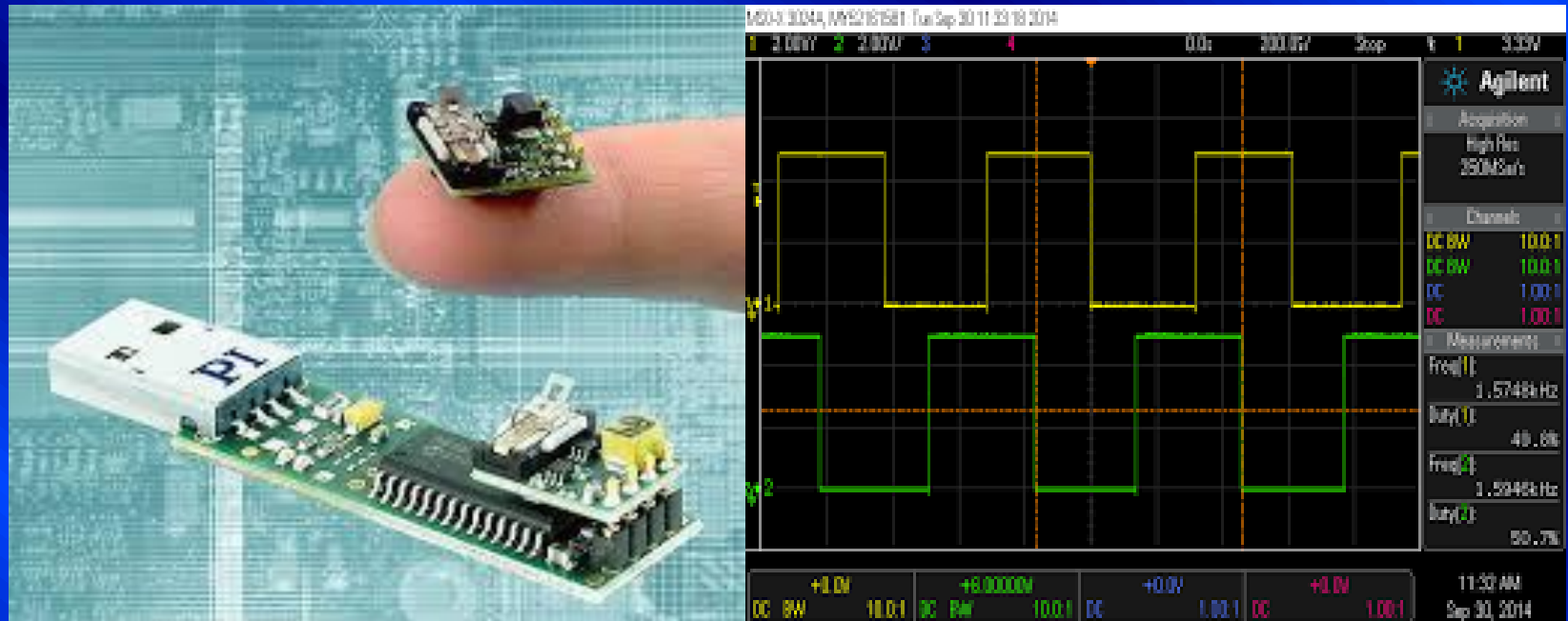
- 20, 000 Hrs
- (run Time)

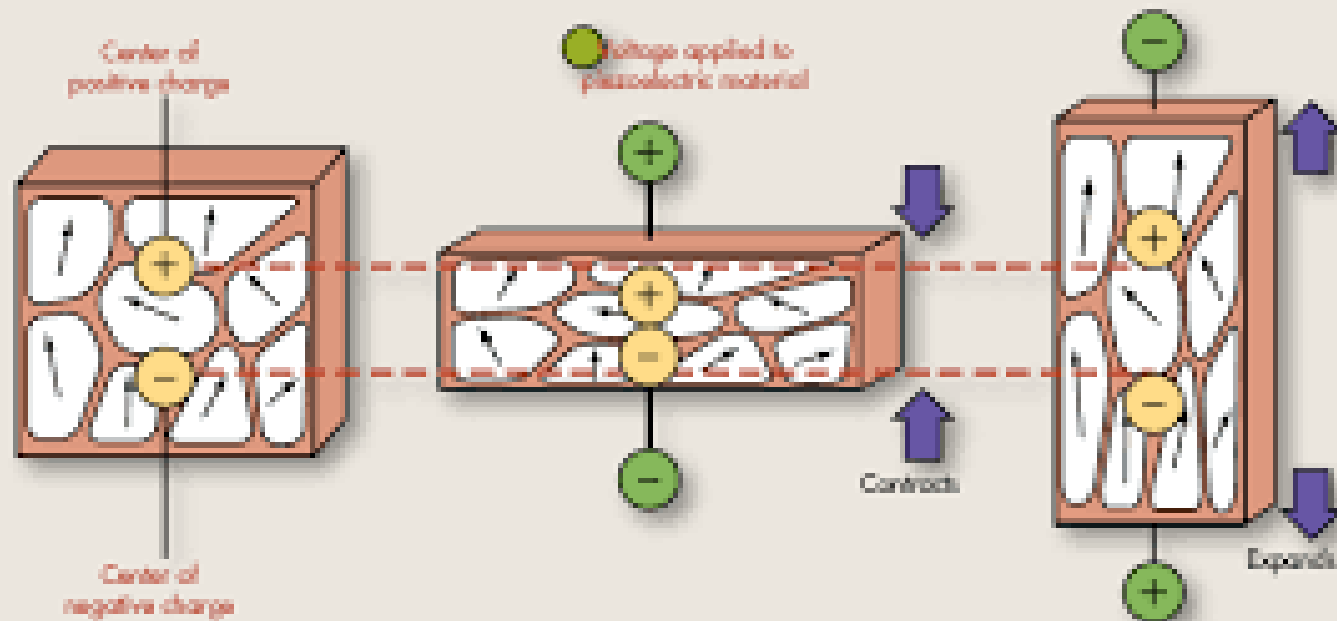


Control Movement

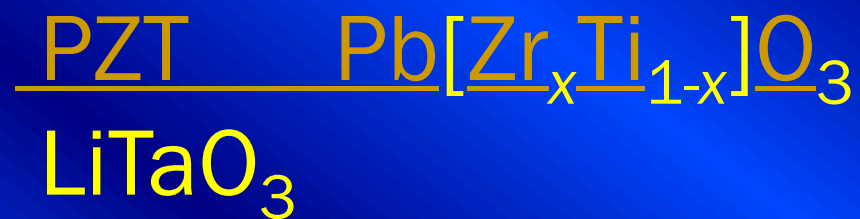
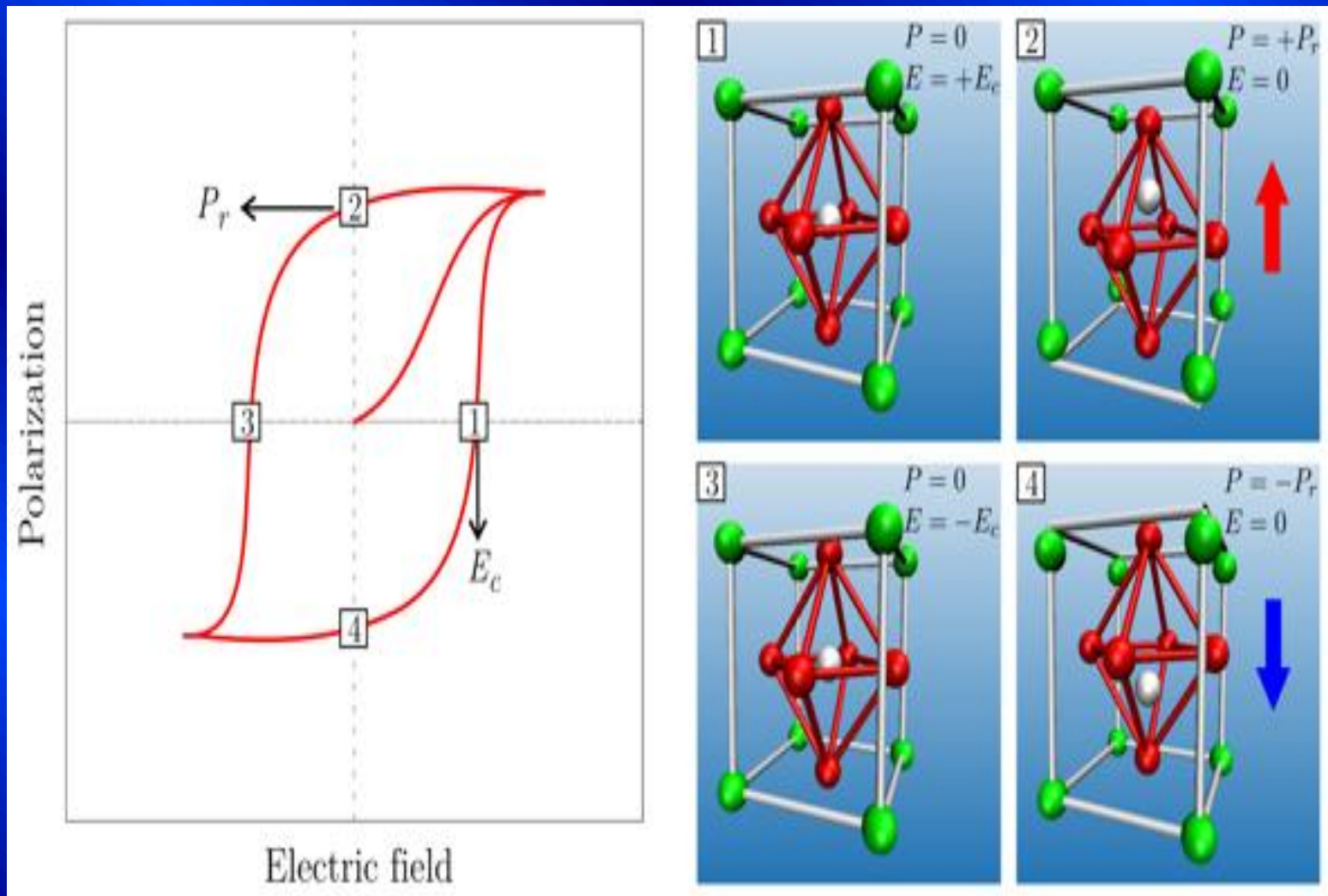


Electronic Circuits

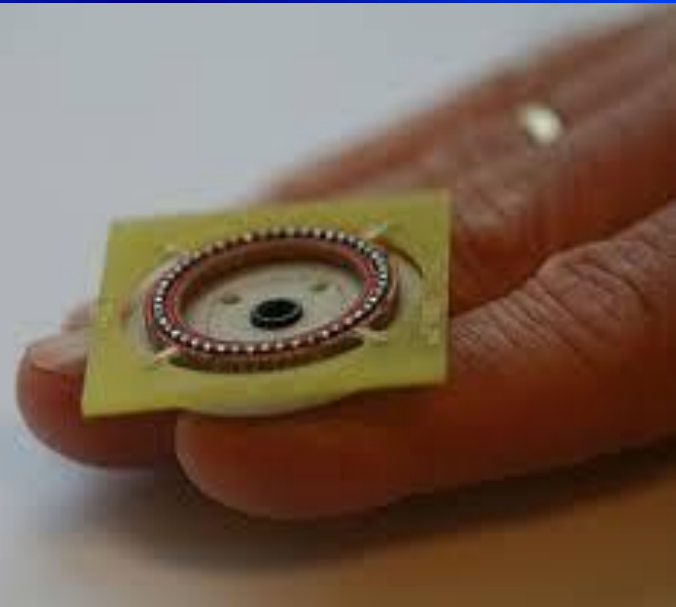
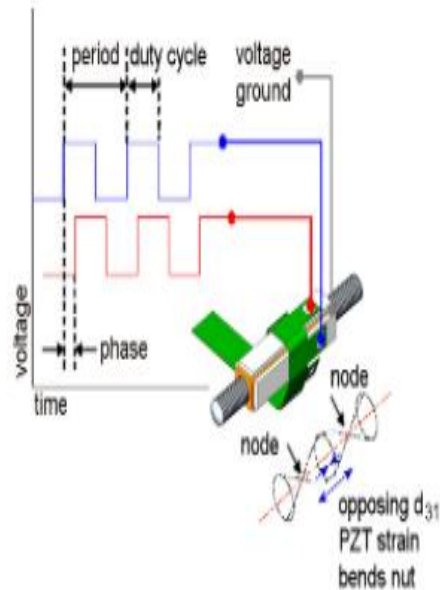
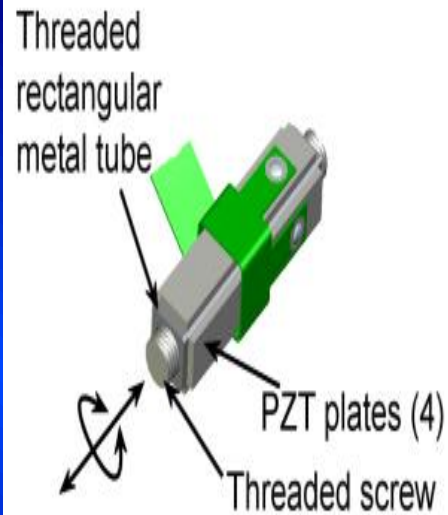




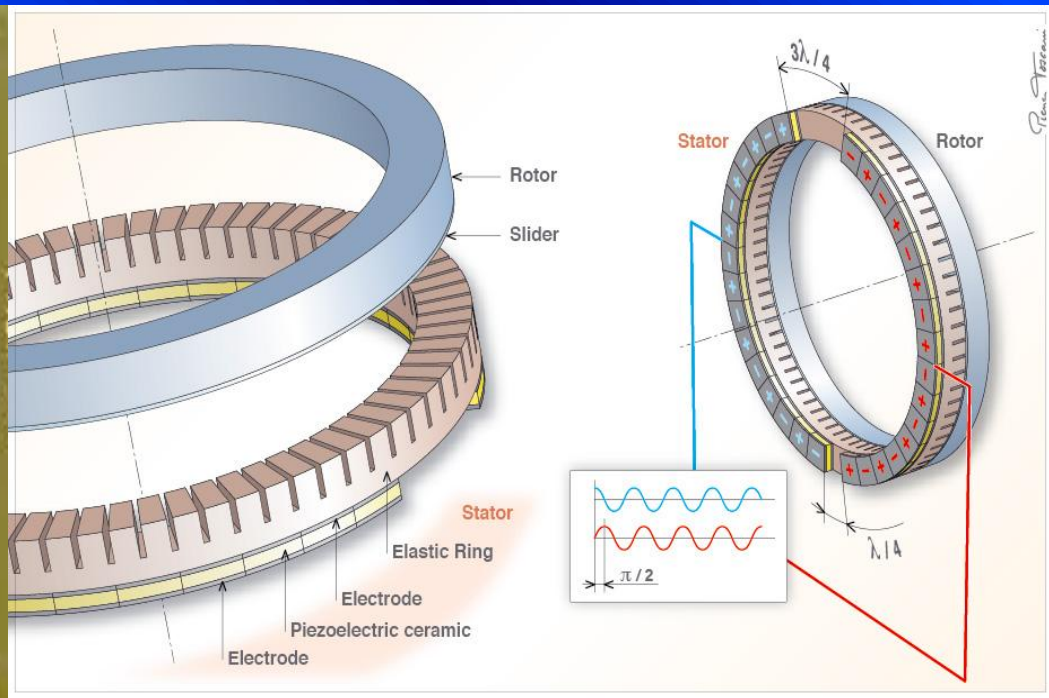
1. The piezoelectric effect causes crystal materials like quartz to generate an electric charge when the crystal material is compressed, twisted, or pulled. The reverse also is true, as the crystal material compresses or expands when an electric voltage is applied.

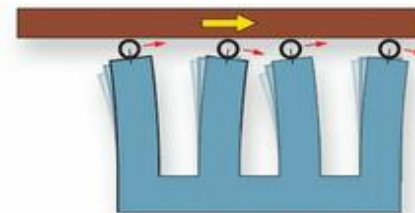
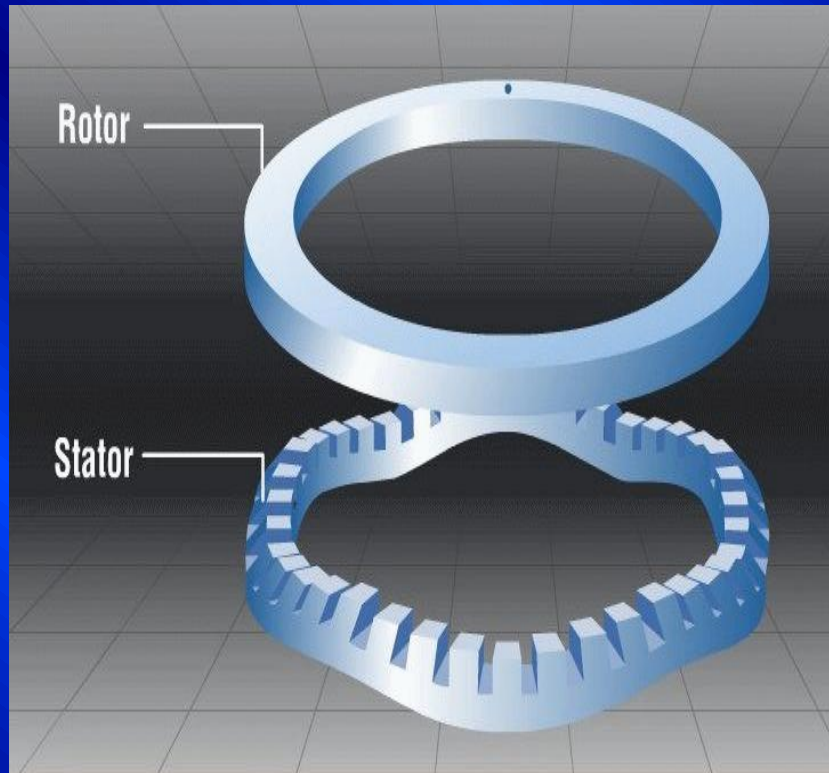


Distribution of Squire Waves

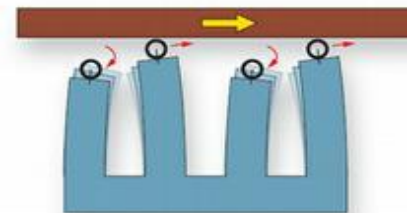


Nano Piezo Motor

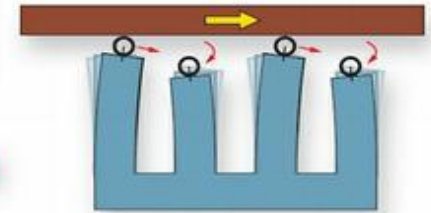




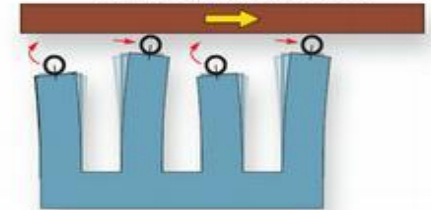
1. At startup, all four legs are elongated and bending, pressing against the armature of the motor.



2. One pair of legs retracts away from the armature and moves to the left, while the other pair of legs bend to the right pushing the armature in that direction.



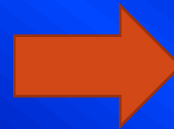
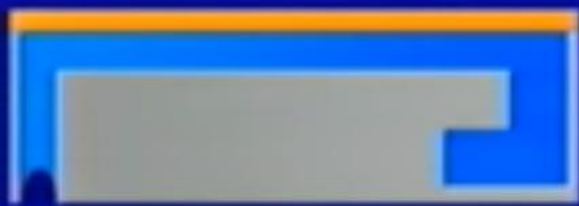
3. The leg pair that initially retracted now extends to push against the armature, while the first pair that pushed the armature to the right retracts.



4. The second pair bend to the right continuing to push the armature in that direction while the original pair of legs now move to the left, preparing to start the walk cycle again.

Nano Technology in Laser Printers (Cartridge)

Piezoelectric element



Piezoelectric element



Simple operating waveform



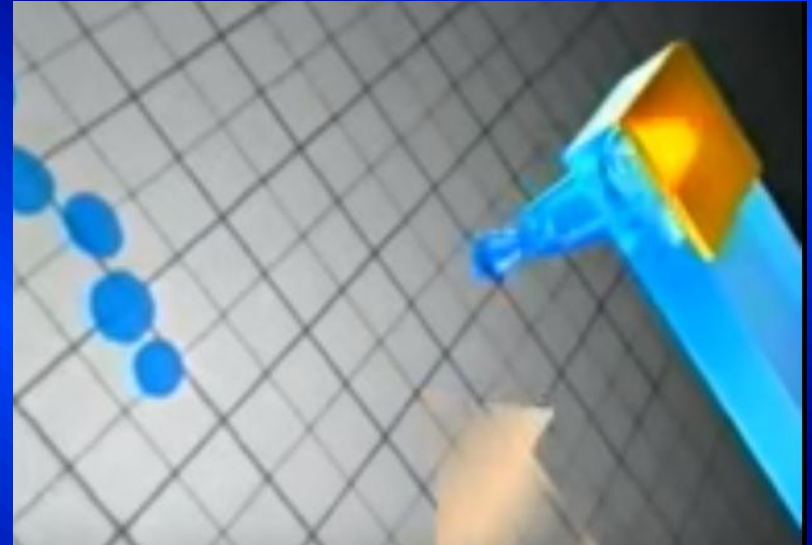
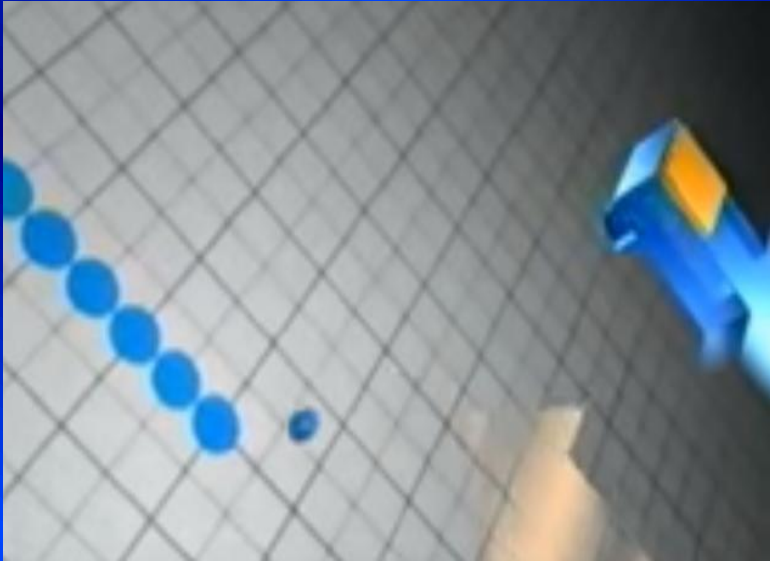
Drive

Simple operating waveform

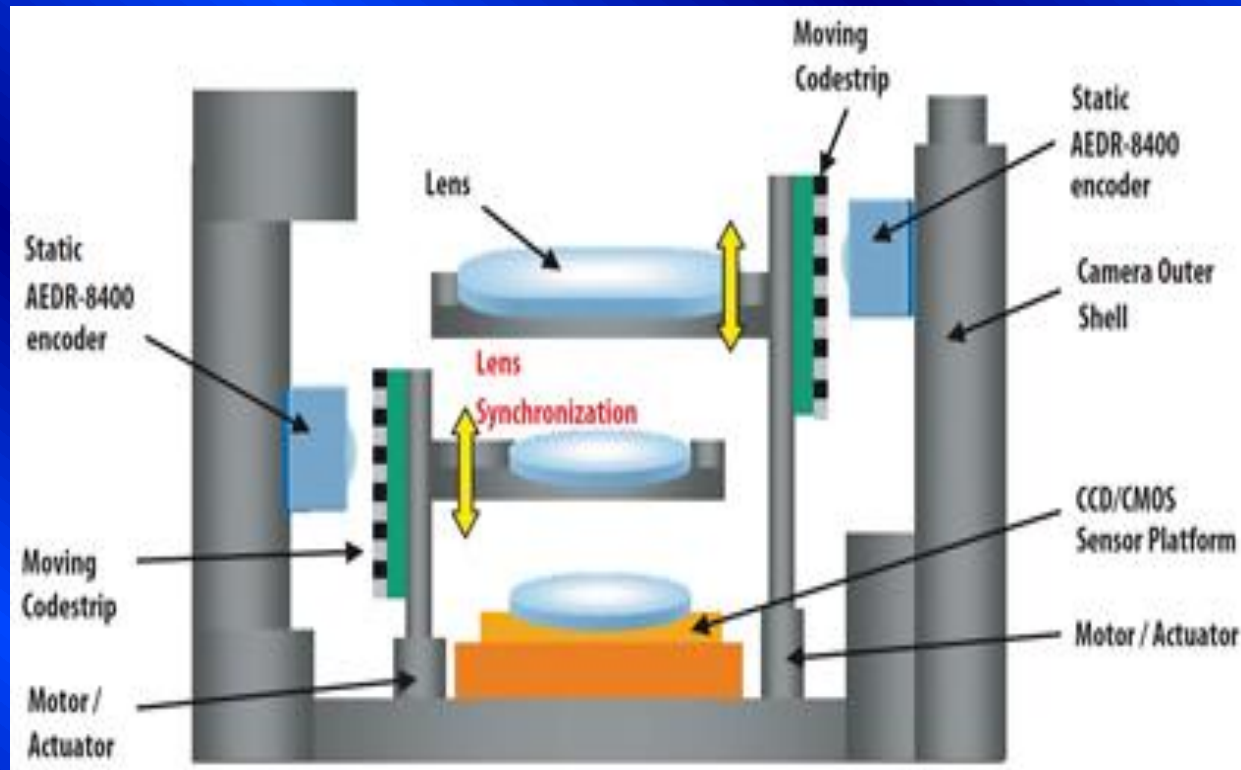


Drive waveform

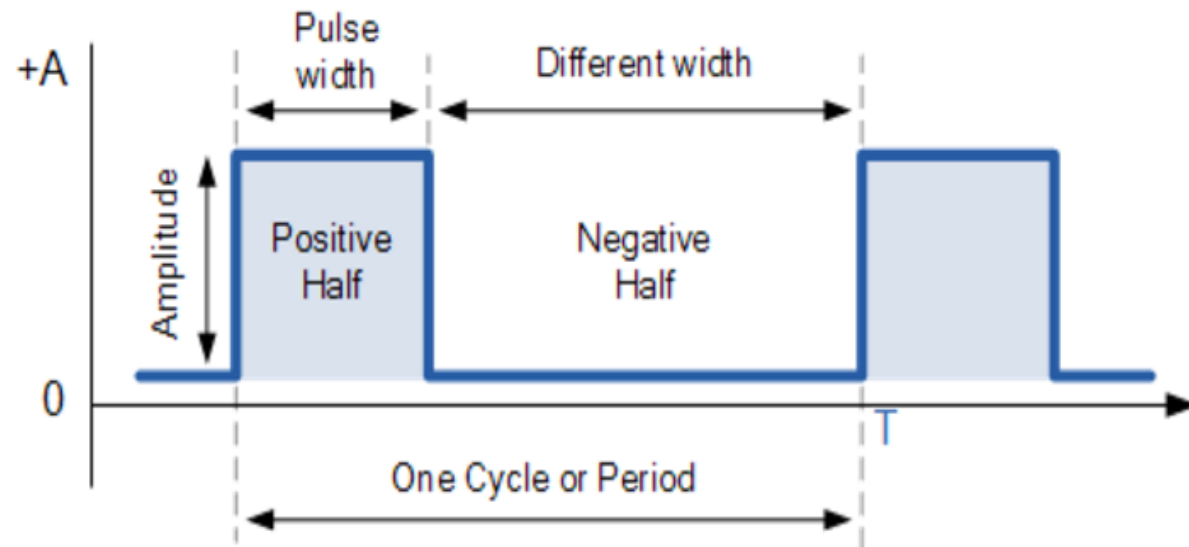
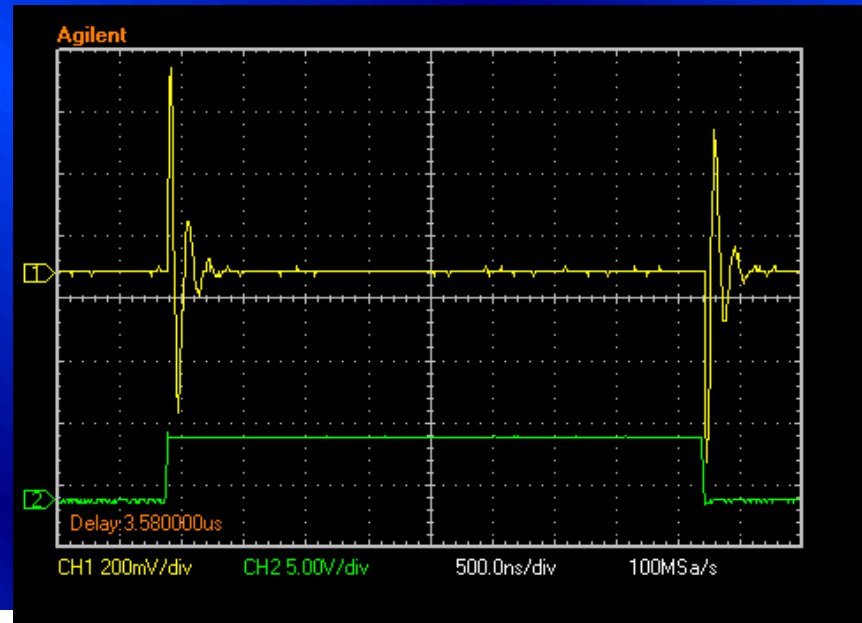
Nano Technology in Printers



Nano Technology in Cameras



Squire Wave



THANK YOU

