

# 溫度、角度、力量、振動感測器



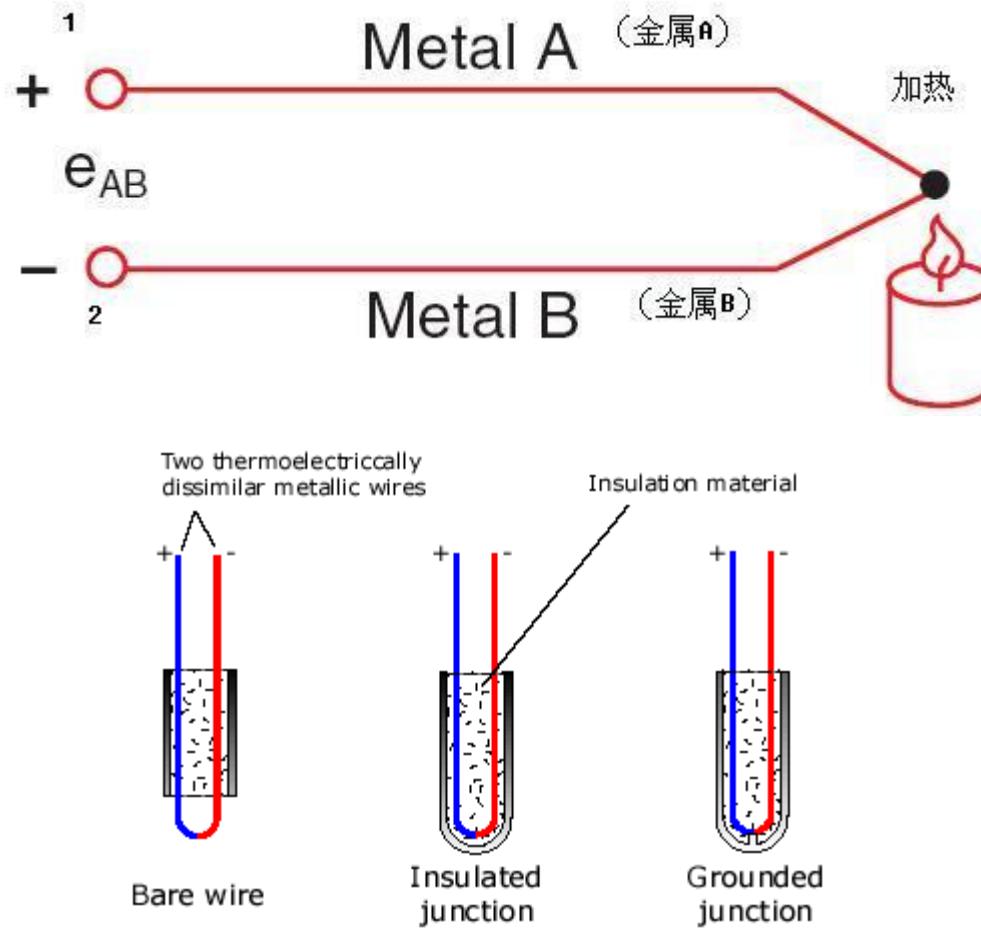
(應用例)

范光照

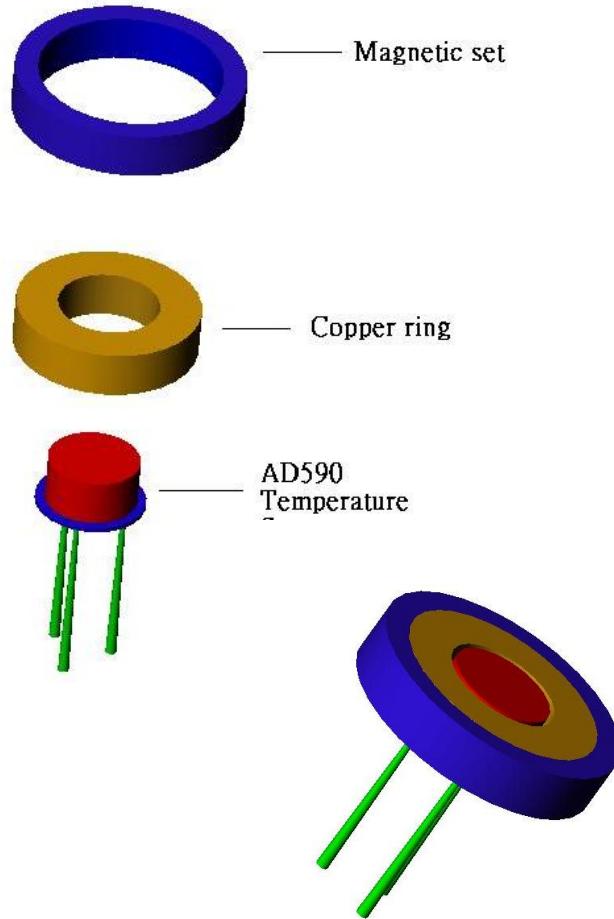
台灣大學

2014

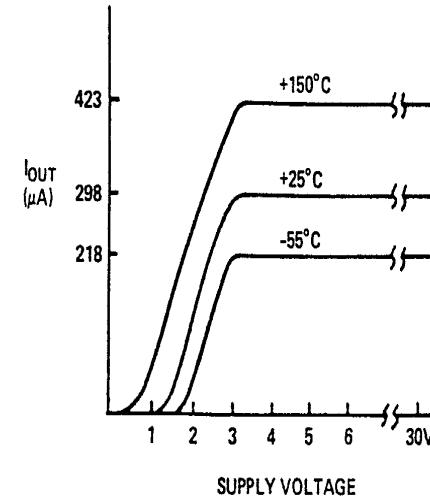
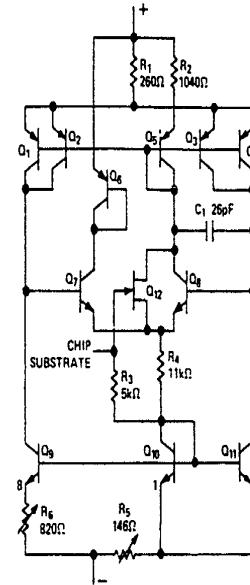
# 一、溫度感測器應用例



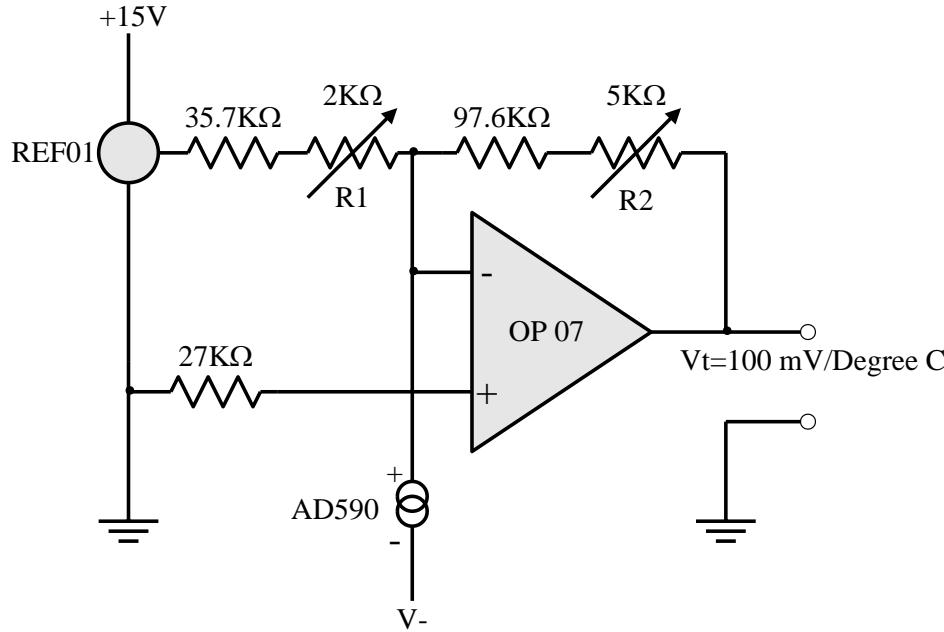
# AD590 temperature sensor IC



## 工作原理



電晶體Q8、Q11產生正比於絕對溫度電壓，電阻R5、R6轉換電壓為電流，電晶體Q10使總電流正比於絕對溫度。AD590供應電壓與電流輸出特性，顯示供應電壓至少+4V以上。



AD590在正常工作下，  
1K的溫度可轉換電流  
1 $\mu\text{A}$ ，電流信號不因導  
線長度不同而產生衰減  
差異，用一顆工作放大  
器(OP07)即可輕易將電  
流信號轉換成電壓信號

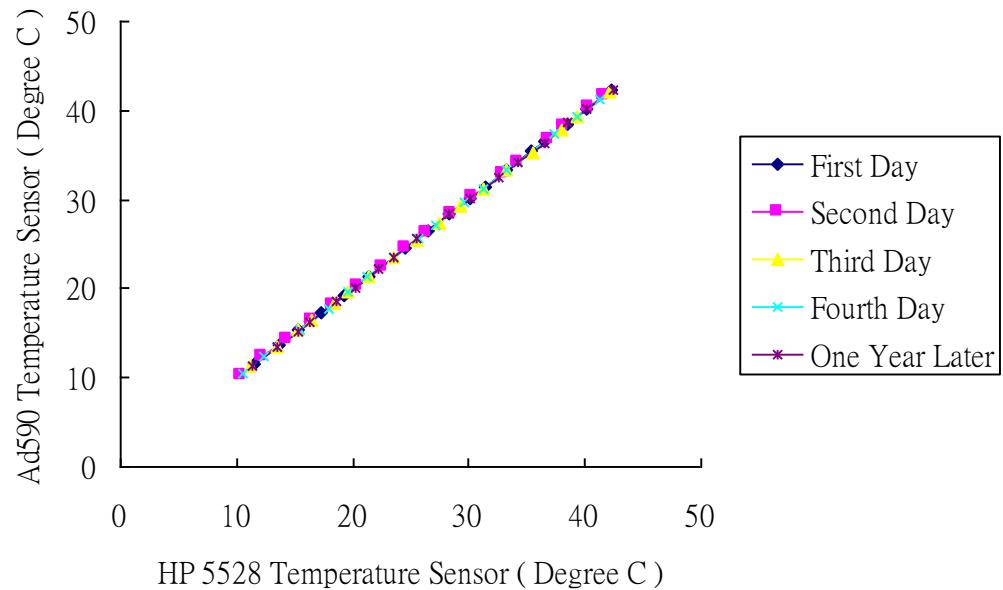
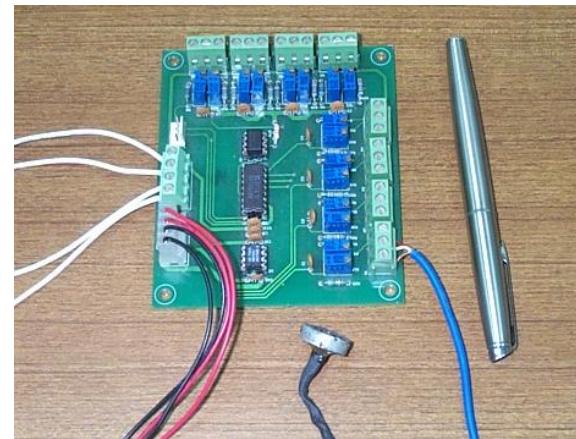
# 8-channel AD590溫度板製作



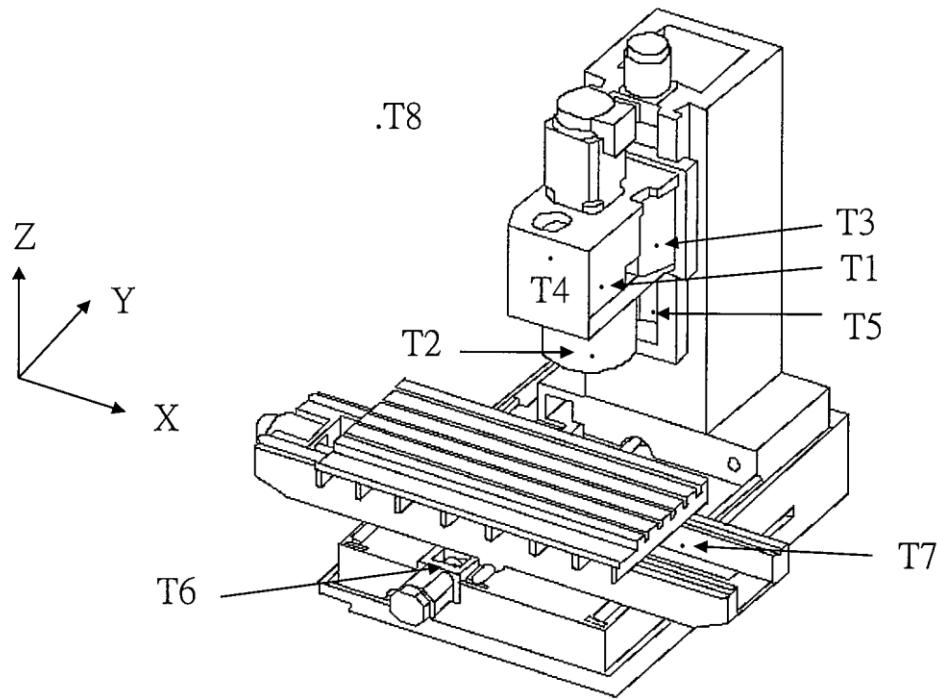
多工器(multiplexer AD7501)

切換8顆不同溫度感測器；

類比的電壓信號則透過A/D  
轉換成數位信號，進入微處  
理器(可選擇使用單晶片  
8051或AVR，透過I/O介面  
卡進入一般PC)作運算處理  
，計算出實際溫度值。

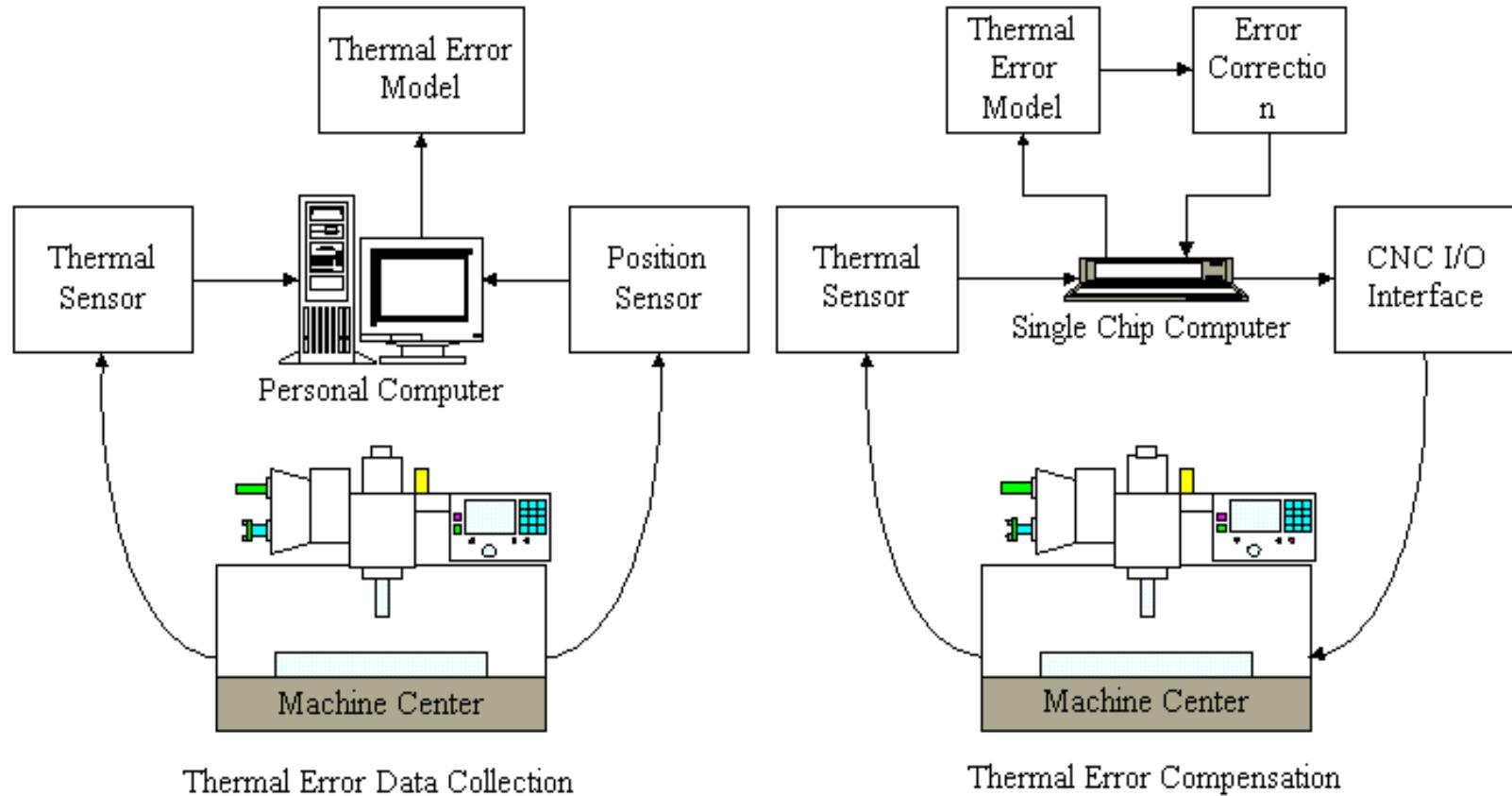


## Initial Locations for Temperature Sensors



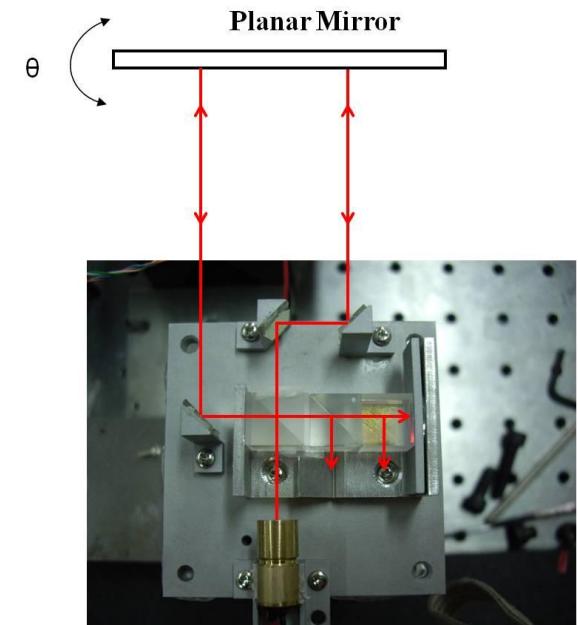
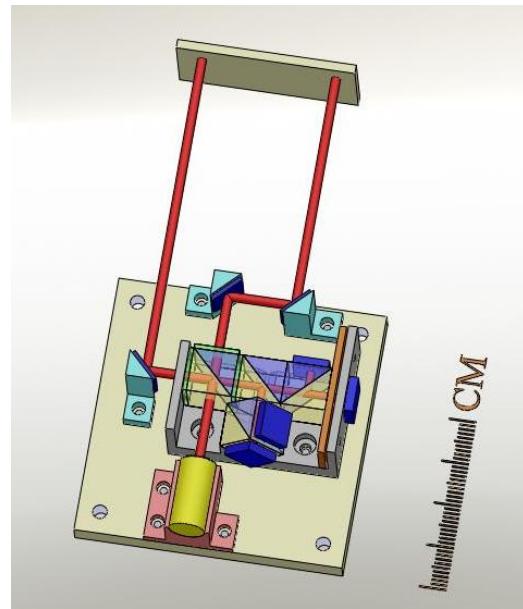
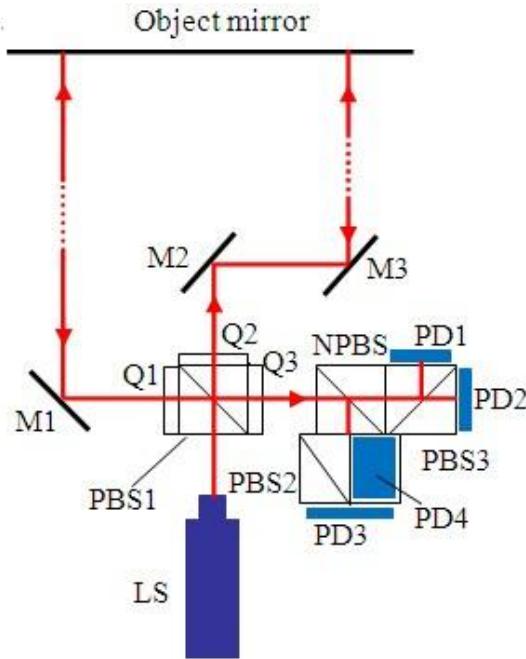
| 感測器號碼 | 吸附位置      |
|-------|-----------|
| T1    | 主軸頭部右側    |
| T2    | 主軸套筒後方    |
| T3    | Z軸滑軌右側    |
| T4    | 主軸馬達      |
| T5    | Z軸滾珠導螺桿螺帽 |
| T6    | Y軸滾珠導螺桿螺帽 |
| T7    | X軸滾珠導螺桿螺帽 |
| T8    | 室溫        |

# Thermal Error Compensation Strategy



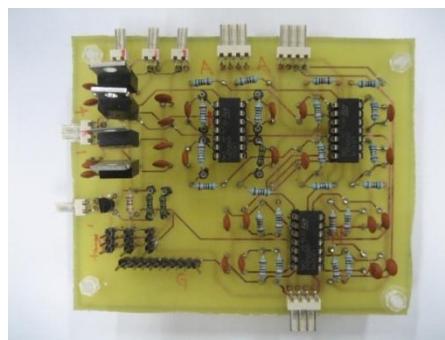
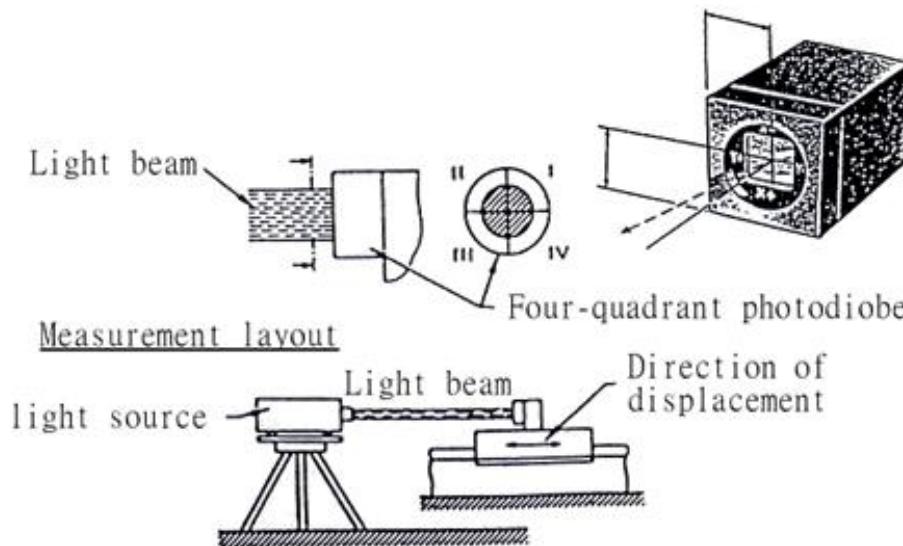
## 二、角度感測器應用例

## Example: a yaw interferometer

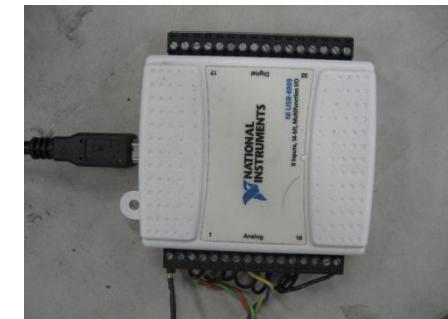


雷射準直儀原理：

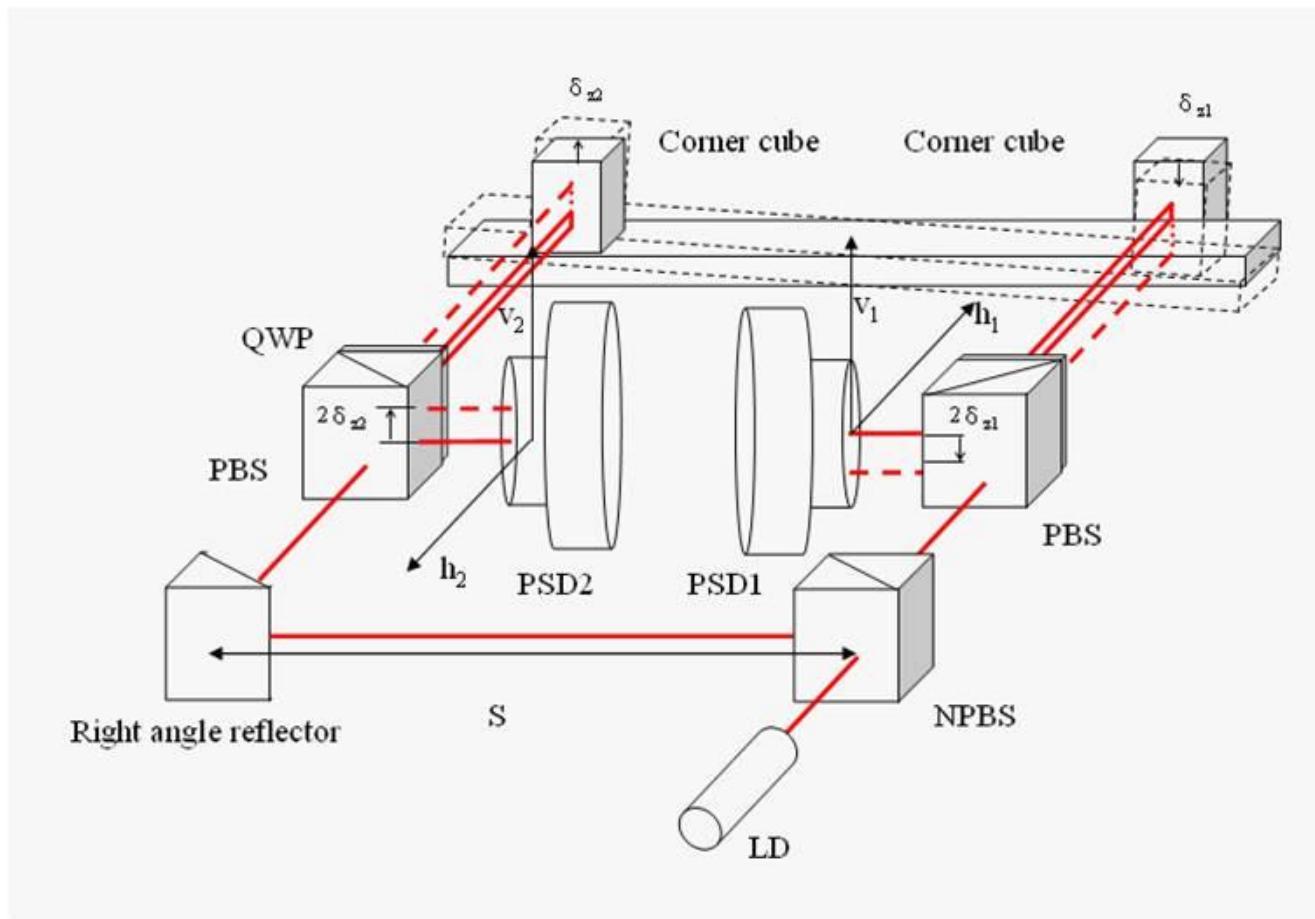
準直雷射光 + 四象位光感測器



1. 四象位感測器(SPOD-9d)
2. 準直雷射(Thorlabs Laser)
3. 電流轉電壓&放大電路板
4. 單晶片處理器(AVR)
5. DAQ卡



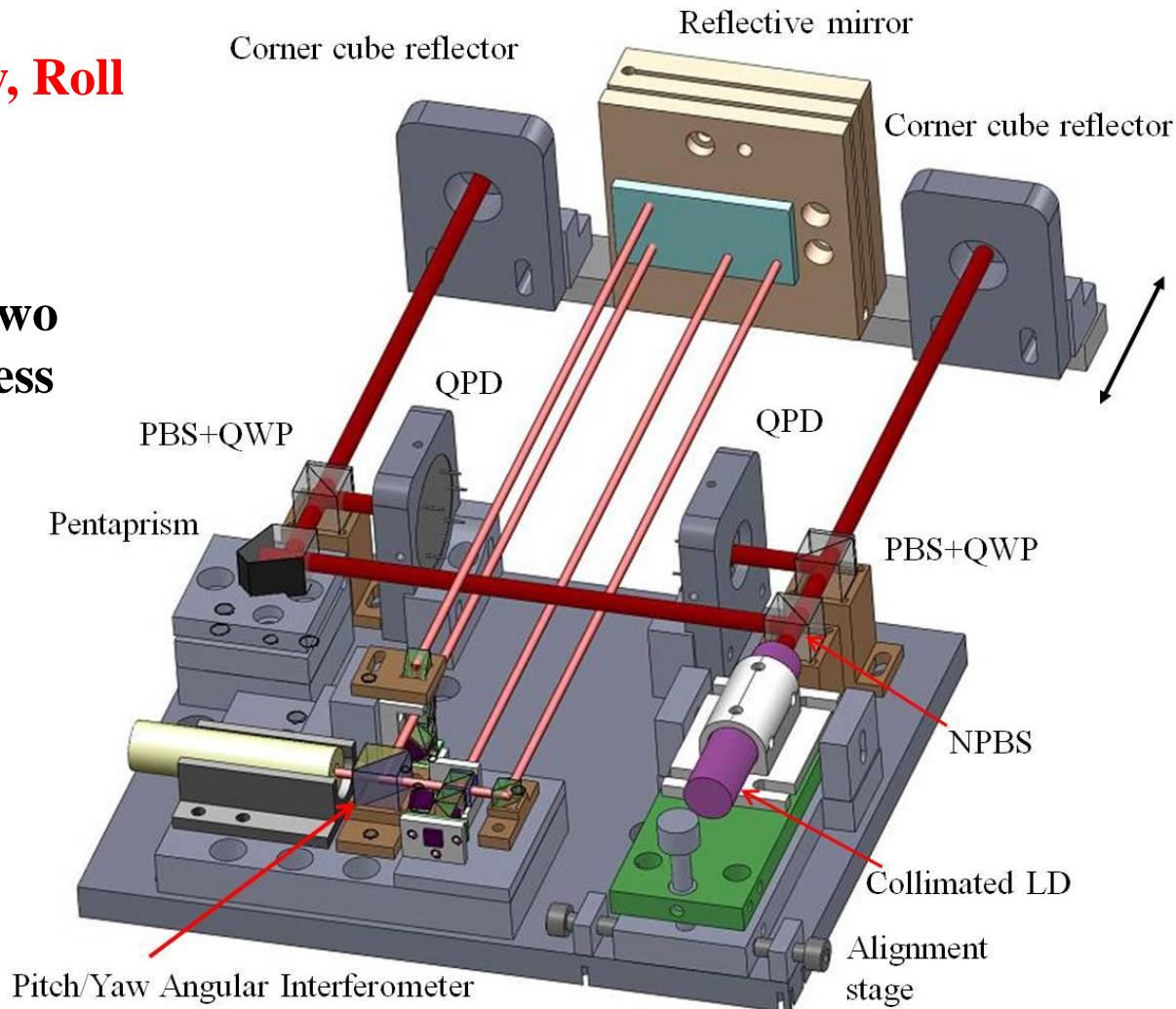
# Design of a Roll Sensor



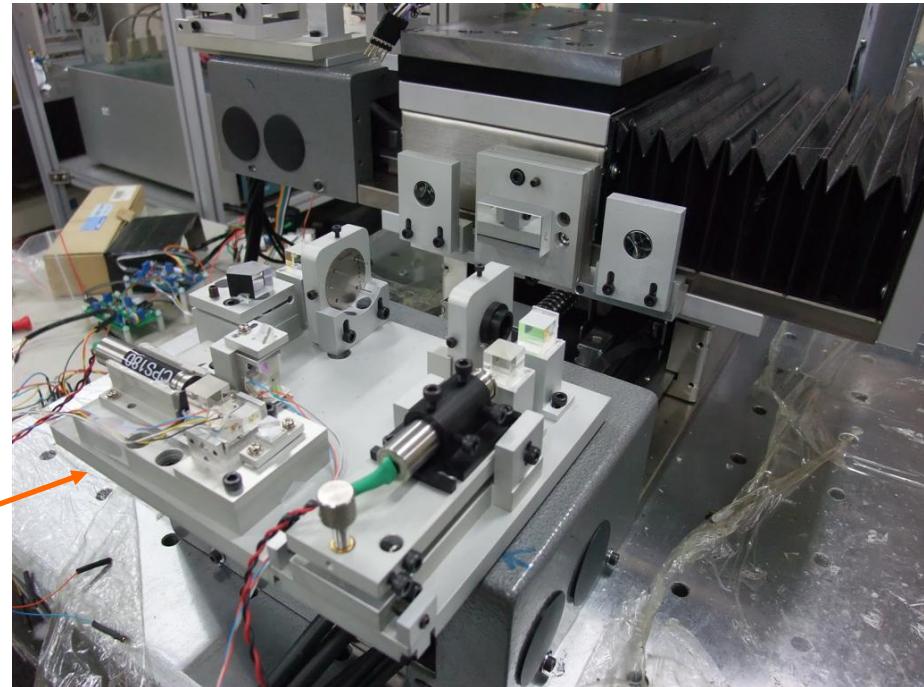
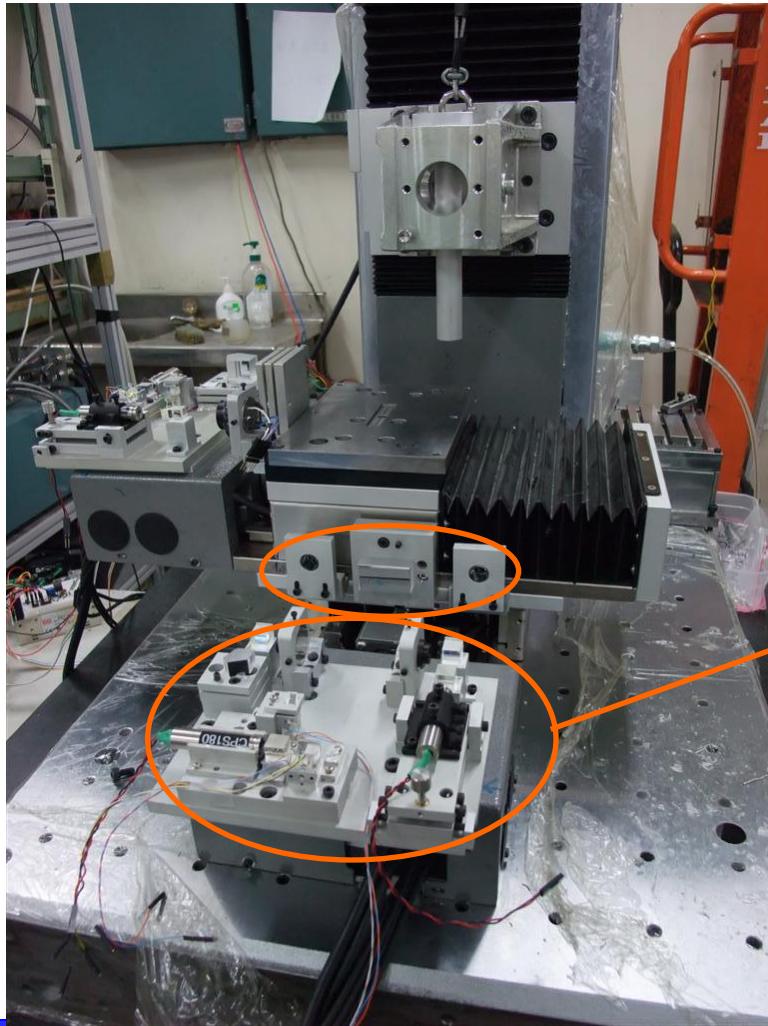
# 3-axis Angle Sensor System

Pitch, Yaw, Roll

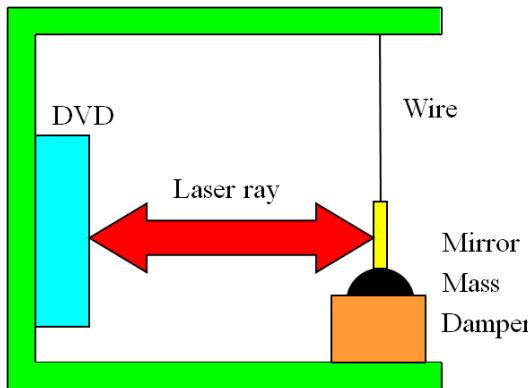
Also for two  
straightness  
errors



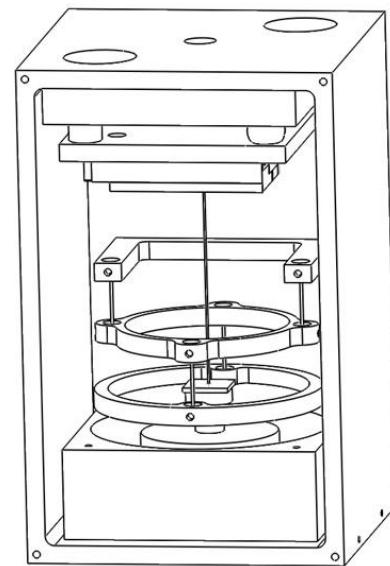
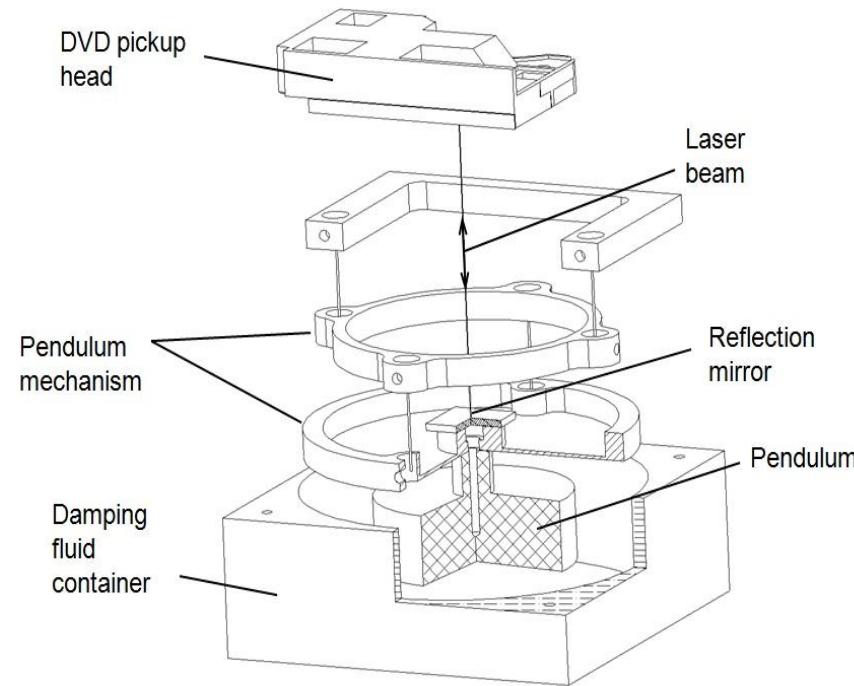
# Photos of Installation in the Machine Tool



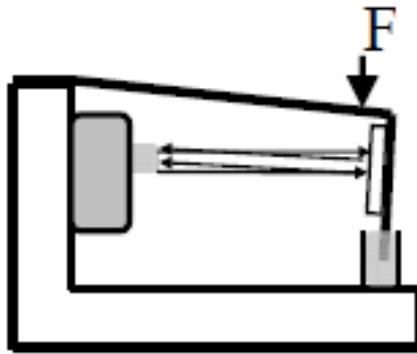
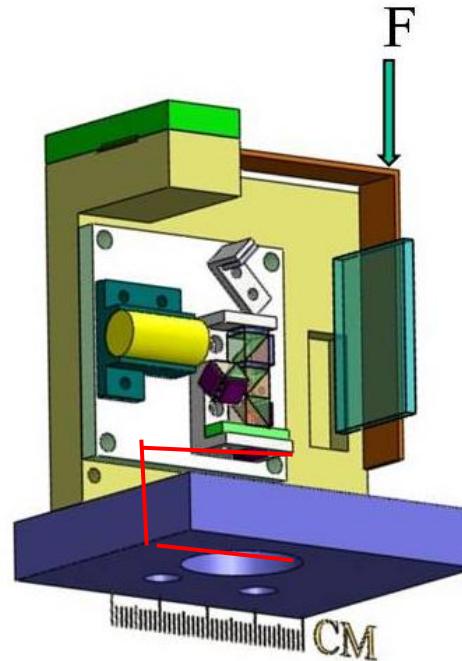
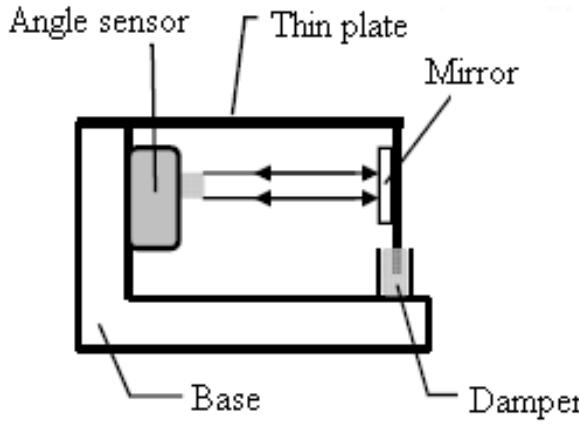
## 單擺原理



## 雙軸水平儀設計

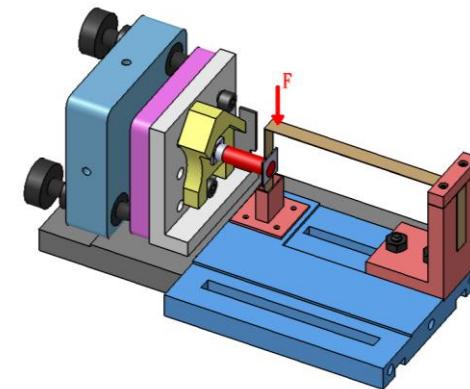


### 三、力量感測器應用例



## 工作原理

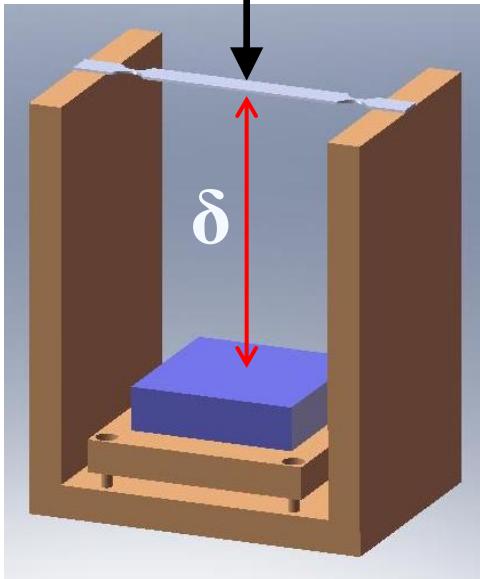
1. 懸臂梁受力彎曲
2. 量測彎曲角度
3. 裝置角度感測器



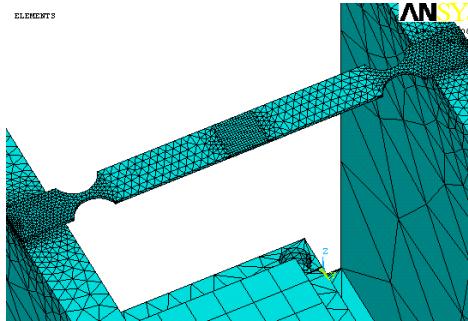
F



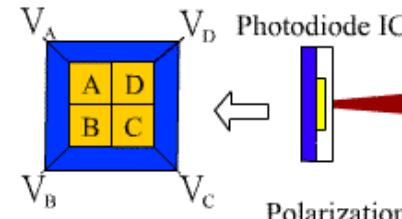
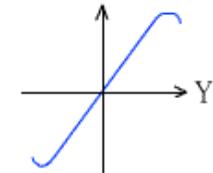
$\delta$



ELEMENTS



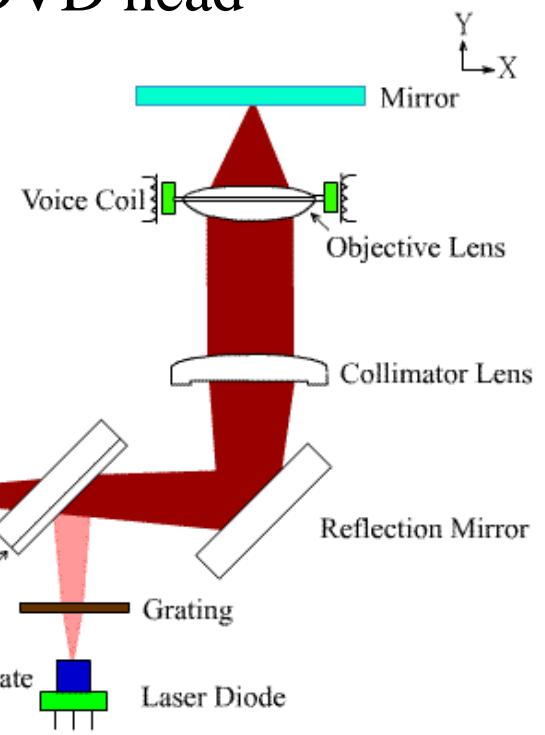
$$(V_A + V_C) - (V_B + V_D)$$



Polarization Beam Splitter  
Quarter Waveplate



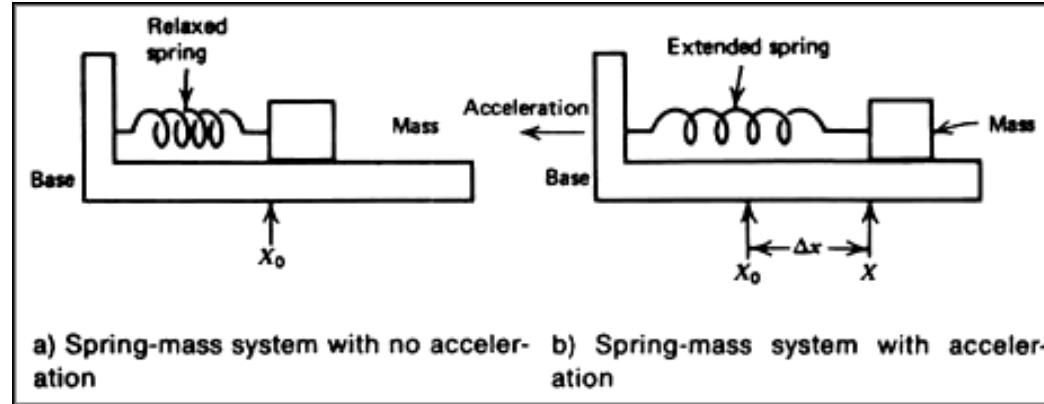
## Principle of DVD head



更換受力片可  
改變測力大小

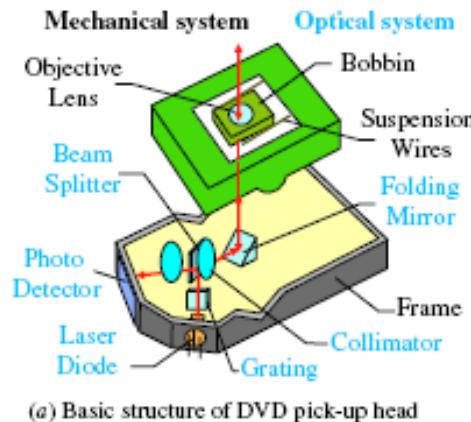
## 四、振動感測器應用例

# 加速度規 (Accelerometer)

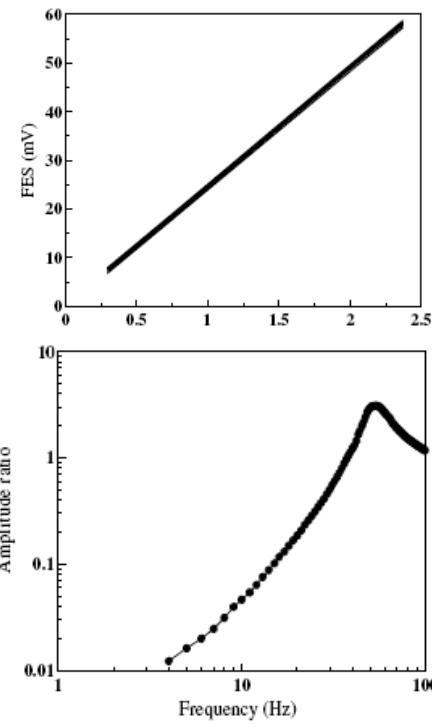
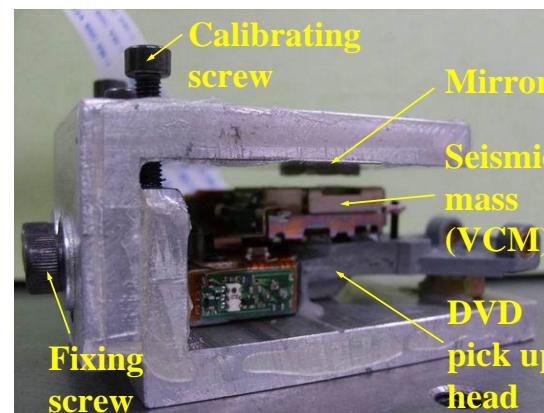
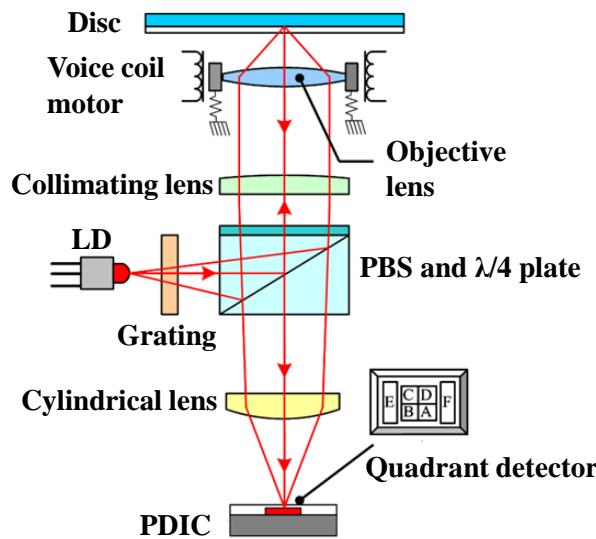
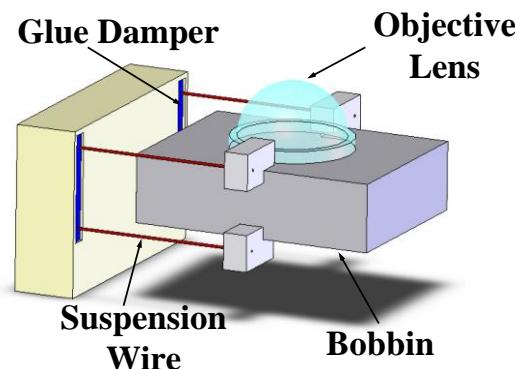


$$m\ddot{x} = K\Delta x$$

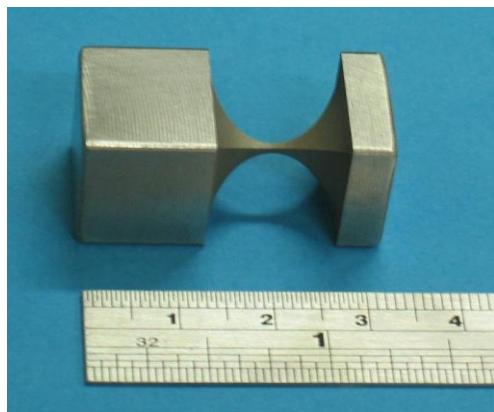
# 1-D DVD Accelerometer



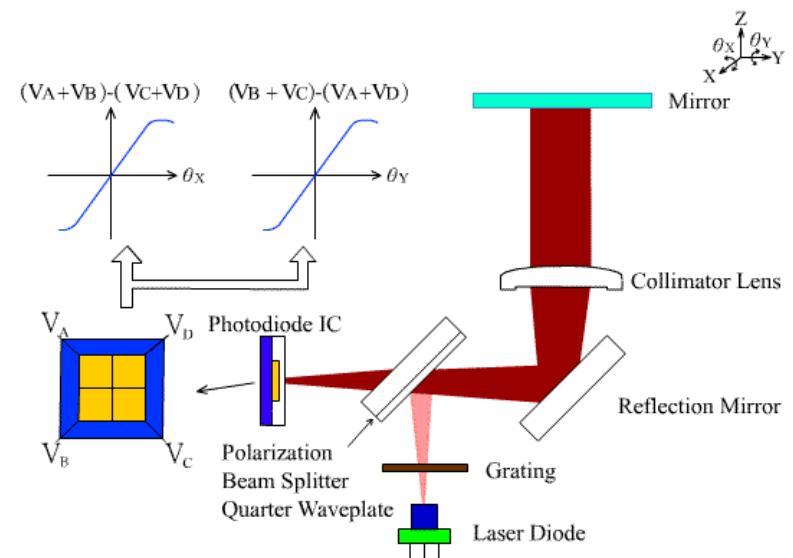
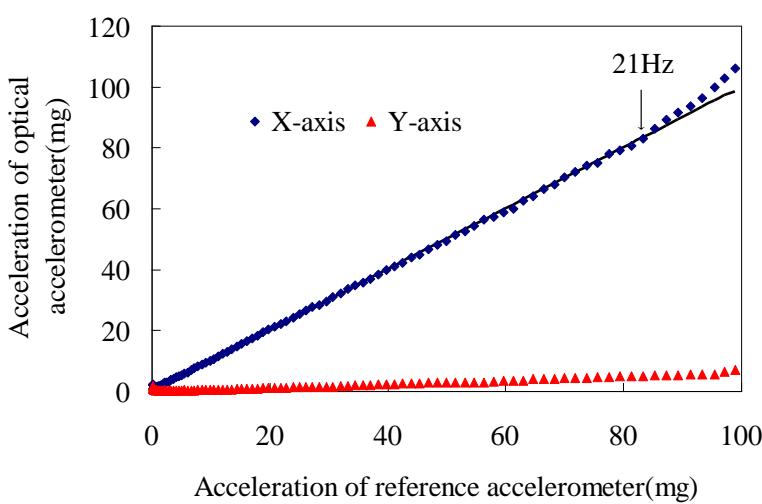
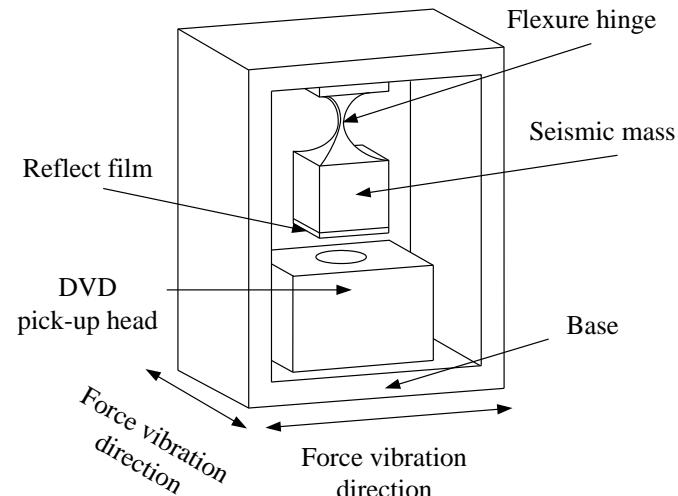
1D



# 2-D DVD Accelerometer

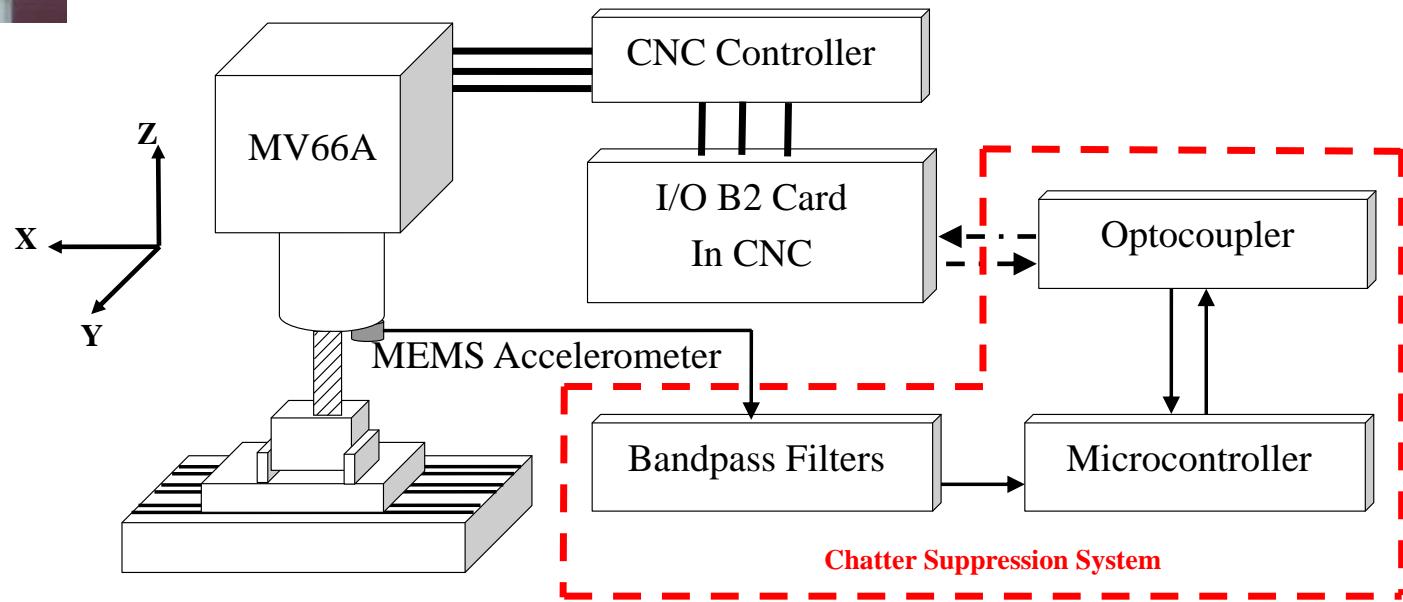
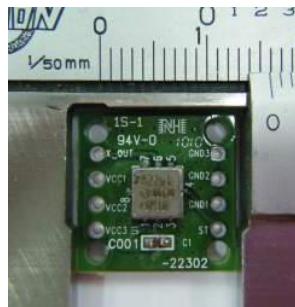


2D



# Machine chatter suppression

3-D MEMS accelerometer



Chatter marks



→ Cutting Path

