



## Computer Engineering and Mechatronics MMME3085

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### Exercise Sheet 6: Data conversion and sensors

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1. What kind of ADC would you use for the following applications?
  - a) To connect a computer to a servo-amplifier used for controlling a hydraulic fatigue rig, with the servo-amplifier requiring a varying voltage as its input. **Look for one from the lecture with high accuracy and high speed**
  - b) To measure the voltage representing a water level on a system for controlling the water level in a tank **Look for one from the lecture low accuracy and low frequency**
  - c) To measure the voltage representing a load on a materials testing machine where accuracy is very important **Look for one from the lecture high accuracy and the frequency is not that important**
  - d) To capture the waveform of a 10 MHz electrical signal so as to be able to analyse the shape of its wave. **Look for one from the lecture high accuracy and high frequency**
  
2. What hardware (sensor/transducer and interface) would you use to read the following quantities into a PC or dedicated computer-based controller?
  - a) The position of a "doctor blade" (a mechanical scraper) on a filament winding machine; the blade's position is very finely controllable via a simple lever, and its position is crucial to the production of consistent quality material. Assume that its operating mechanism has a travel of 20 mm more or less in a straight line. **LVDT [the idea: High accuracy is needed with short stroke]**
  - b) The position of a slideway on a machining centre. **Linear encoder [the idea: accuracy is needed and long stroke]**
  - c) The angular position of a servomotor, which by making many rotations positions a laser cutting head over a workpiece. (The laser head is moved via a toothed belt tangential drive similar to the drive on a dot-matrix printer head). Note that by measuring the angular position of the servomotor, you wish to be able to measure relative movements of the laser head relative to an initial "home" position. **Absolut Rotary Encoder [the idea: absolute measurement is needed]**
  - d) The temperature of a motor, for condition monitoring purposes, **Thyristor or Thermocouple [the idea: no accuracy is needed]**

- e) The degree to which a loaded component deforms, with a view to sensing the load which it carries (noting that calibration of the resulting system would be needed)? What could be done to ensure that environmental changes do not affect the readings? **Strain Gauge [the idea: accuracy is needed and for the compensation, you can use a full bridge with dummy strain gauges]**