As an overview, here are some key take-aways without the technical backup.

Piezoelectric elements self-generate an electrical charge on specific surfaces when deformed. Deformation might come from many sources including direct force, pressure, acceleration, thermal gradients, magnetic fields, bending of the mounting surface, acoustic fields. It is the charter of the design engineer to make an accelerometer responsive only to acceleration, and unresponsive to all the other stimuli. Likewise, a force sensor and a pressure sensor should be designed to be insensitive to all other stimuli except for force and pressure, respectively. This is usually not a simple task.

A **performance specification** should be carefully reviewed to understand a sensor's sensitivity to the 'unwanted' environments mentioned in the previous paragraph. A sensor manufacturer usually supplies three types of performance specification categories:

- parameters that are measured and reported for each sensor supplied (calibration results)
- parameters that might be measured but not reported (maybe a type of lot acceptance)
- parameters that were only tested during the design phase

It is important to understand that these parameters are often interdependent. For example, a sensor will have a specified temperature range which it should operate (usually with degraded performance at elevated temperatures). The temperature range and degradation effects should be conveyed in the specification. What is NOT stated is the effect temperature might have on noise, bandpass filters and such.

The output of the sensor will mainly (hopefully) depend on the intended measurand (acceleration, pressure, force) but it will be very likely to have some output from spurious inputs. It then becomes important to ensure the sensor performance is stable over time. Keeping the sensor on a regular calibration cycle gives the test engineer confidence that the sensor itself hasn't changed its characteristics. When a sensor is to be replaced, it is often wise to replace it with the same (or similar) product. You don't want to be fooled with variation of data mainly caused by variation of sensors.

Select a sensor that won't affect the measurement (don't let the tail wag the dog). A common error is to mount a massive accelerometer on a light test specimen. Just don't do that. A good rule of thumb is to mount a sensor and run some tests. Then mount an extra mass equal to the accelerometer (any metal slug will do) and repeat the tests. If the data look the same, then the accelerometer mass is appropriate.

Consider **the signal beyond the piezoelectric sensing element**. This element is often installed in a metal shielded housing to protect from EMI. This means the sensing element is wired to a connector. Wires can resonate, and a resonant wire will likely show in the sensor's output. The sensor designer often finds that connecting the charge signal to the outside world can be challenging. The signal from the connector passes through a cable… another source of potential problems. When facing errors from a system, it is a good habit to check the cable first. Past the cable, the signal should be routed to a signal conditioner and/or data acquisition system. Make sure it is appropriate and well understood to discriminate the data.

The signal generated on surfaces of the piezoelectric element are essentially bound charges, contained within the bulk of the piezoelectric material and do not flow. They are like static electricity found on a rubber balloon, or static cling of clothes. If you are interested in energy harvesting, consider a magnet and coil.

Piezoelectric sensors are not responsive to static acceleration. When you flip one over on a test bench, the output will change to show a change of 1g of acceleration, and the signal will decay back to zero subject to the time constant of the high-pass filter characteristics of the system. Recognize this as a detriment and a blessing compared to sensors that are DC responsive (like MEMS accelerometers). Select an accelerometer system with a low frequency filter that encompasses any data you are looking for, considering that higher corner frequencies will conveniently filter out unwanted input like those cause by thermal changes. MEMS accelerometers that are responsive to static acceleration are typically not exactly zero when the acceleration is zero. The error will be called ZMO which stands for Zero Measurand Output. It should be small, but it will be there. If this signal is integrated to derive velocity and displacement, then any ZMO can affect these results in a really bad way. Take ZMO very seriously when considering MEMS accelerometers when very low frequency is important to you.