PZT APPLICATION EXAMPLE USING LISA:

LISA was used for modeling how a type of flying head (used to test magnetic recording disks for asperities) will transmit shock from the point of impact on the air bearing surface to a piezoelectric transducer (PZT) that is on a 'shelf' that is some distance away. I have a non-disclosure agreement with the company in question, so what I can write in this regard is a bit limited.

PZT sensors have sensitivity that depends on direction of compression as well as orientation of bending. Additionally, at extremely high frequencies, complex dynamics can reduce sensitivity of PZT sensors because part of the PZT may be trying to generate a potential (voltage) of one sign, while another part of the sensor can be attempting to generating an opposite potential. Thus, PZT sensors lose sensitivity by partial self-cancellation at very high frequencies.

Sensitivity of PZTs therefore depend on numerous considerations, including their size and shape, and how they are mechanically mounted.

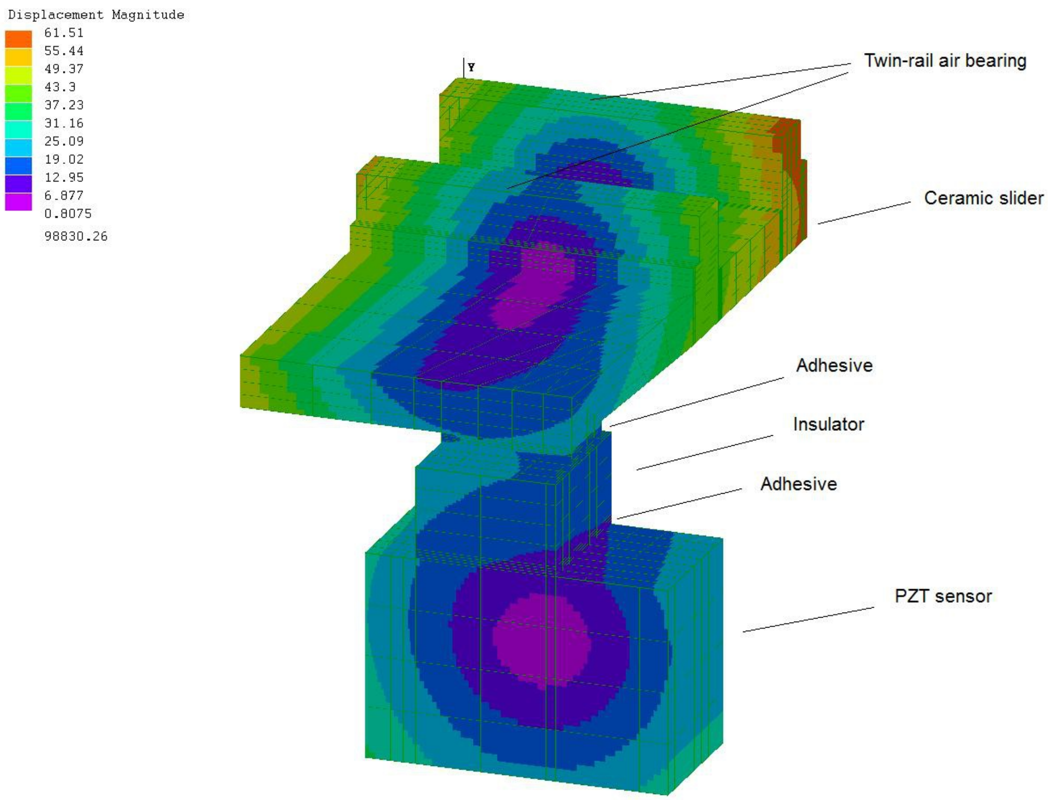
Magnetic recording disks are sometimes tested in the factory by a special type of head that is intended to fly over a good disk upon a thin air bearing, and to lightly bump into a disk with an asperity sticking out of a recording surface. When a bump occurs, a signal is generated by a PZT sensor mounted to the head to detect it.

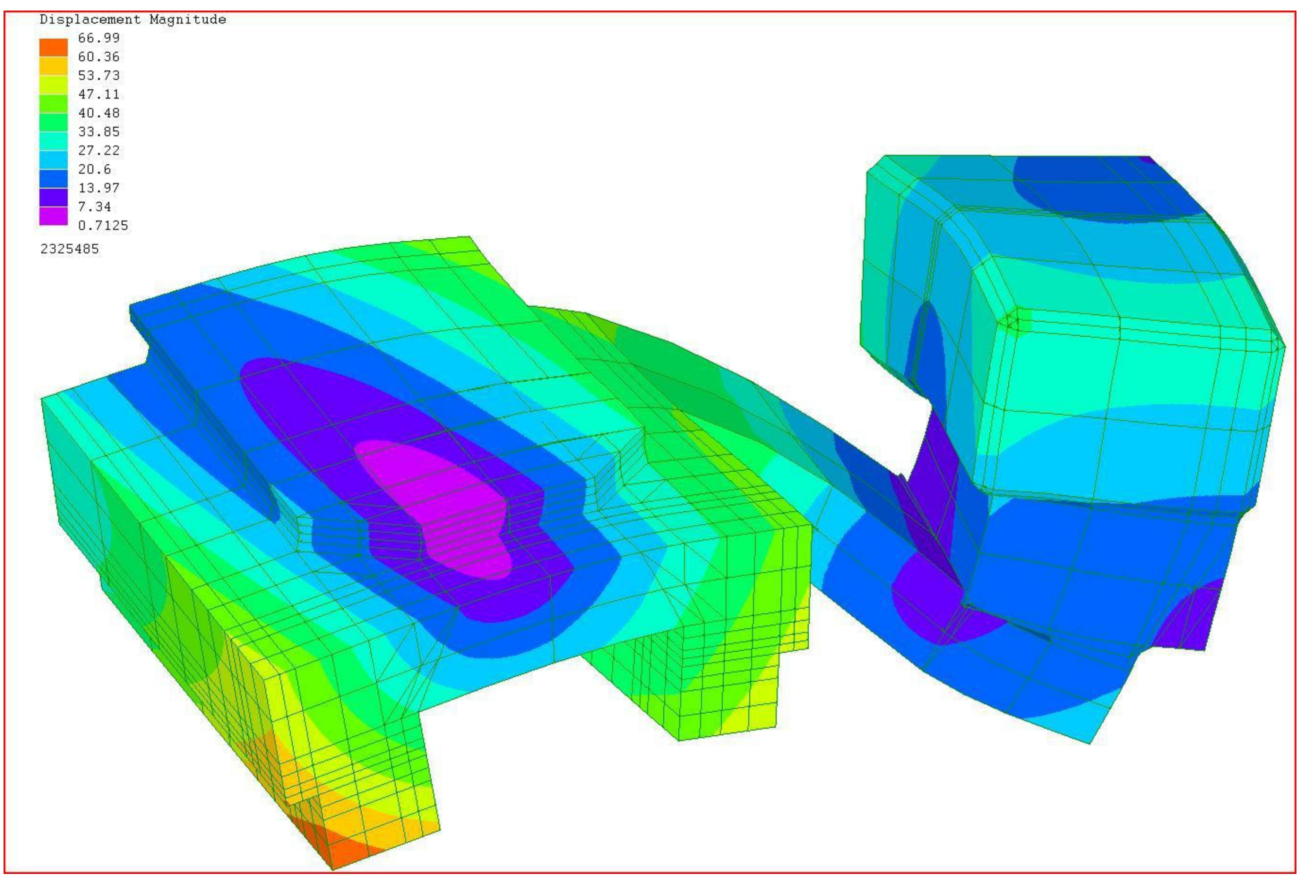
Complicating this is that PZTs tend to pick up signals that are not associated with asperities as well. For example, a disk that is not completely flat (independent of whether the disk is 'good' or 'bad') will generate numerous multiples of 120 Hz when flying over a disk spinning at 7,200 rpm. The PZT thus needs to be rather small in order to detect frequencies well beyond the signals coming from mechanical rotation harmonics with significant amplitude without self-cancellation of signal.

In a specific case here, the PZT is mounted to a ceramic "slider", consisting on a matrix of alumina and titanium carbide. Because the carbide has some conductivity, the PZT is insulated from the slider with a thin layer of glass. This means there are two layers of adhesive as well. The slider has an arm of a width and thickness that needs optimization in order to create the largest signal over a frequency range consisting of the higher end of human hearing to well into the ultrasonic range. In the images attached, the PZT is mounted so that it is half-off of the ceramic arm, in order to increase bending magnitude.

Using LISA, insight was gained regarding how ceramic arm thickness, width, and length affect PZT signal strength over a critical frequency range, in order to detect disk asperities with greater sensitivity.

S. Scott Murray
Scott Murray Software
34683 Teal Common
Fremont, CA 94555-2855
http://scottmurraysoftware.webplus.net/


Displacement Magnitude
61.51
55.44
49.37
43.3
37.23
31.16
25.09
19.02
12.95
6.877
0.8075
98830.26
Y
Twin-rail air bearing
Ceramic slider
Adhesive
Insulator
Adhesive
PZT sensor


Displacement Magnitude
66.99
60.36
53.73
47.11
40.48
33.85
27.22
20.6
13.97
7.34
0.7125
2325485