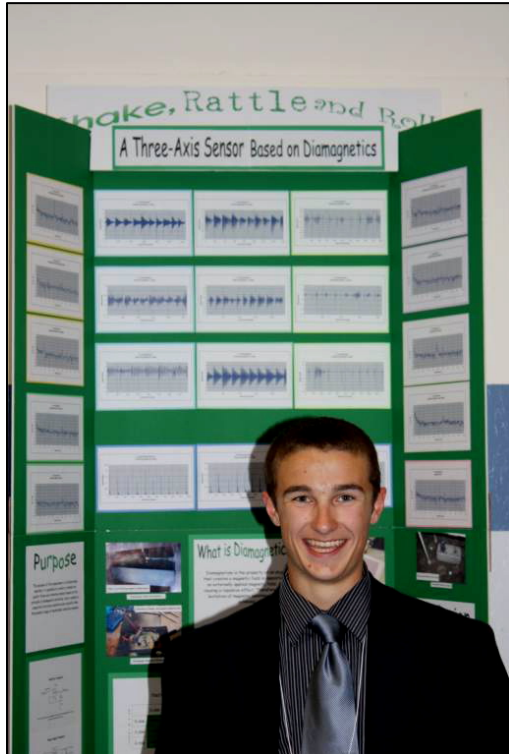


2009 State NMJAS Paper Competition Winner

Ryan C. Erickson

Shake, Rattle and Roll: A Three Axis Sensor Based on Diamagnetics

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Abstract: As long as seismic sensors have been around, inertial masses connected to springs have been the desired system for acquiring vibration based signals. It is believed however, that a more sensitive three-axis sensor can be built using diamagnetic levitation. By levitating a magnet with a diamagnetic plate, it is possible to obtain a near frictionless state. Then, by using specially designed fiber optic pick-ups, measurements of great sensitivity can be obtained. Using an analysis program, the signals can be plotted to give an accurate reading of vibration strength. By dropping a BB from various heights, it was possible to find the sensitivity difference between this and a commercial geophone. The result was a factor of around seventeen in favor of the diamagnetic sensor. Later tests involved measuring the power spectra for multiple sources. This demonstrated the sensor's ability to distinguish between a range of sources, giving it tremendous potential. This sensor has the ability to be used in a variety of fields due to its large dynamic range. This means that it can be used for large-scale measurements that current sensors cannot. Another advantage of this sensor is its potential to be machined as small as an integrated circuit. This would be helpful to the industrial sector, as the circuit would have the ability to discern when a moving component is loose or out of balance. So, while spring based sensors have sufficed until now, their time is past. A diamagnetic sensor is the geophone of the future.