Springless / Low Distortion / Velocity Sensor

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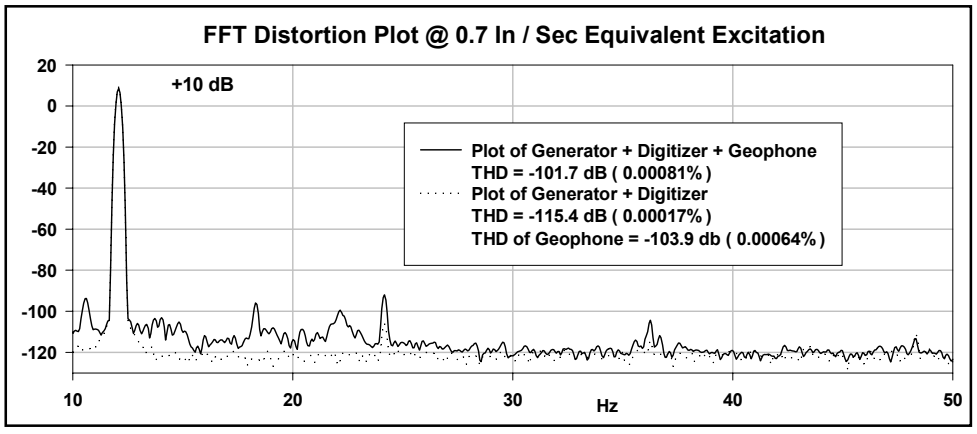
Abstract

Texas Components has developed and patented a velocity sensor that utilizes magnetic fluid technology to suspend a cylindrical rod magnet within a cavity. The small magnetic dipoles within the fluid are forced to align themselves with the lines of magnetic flux of the rod magnet, causing the fluid to become 'stiff'.

This property of the fluid forces the rod magnet to the center of the cavity where the forces are in equilibrium. This creates a device whereby the rod magnet is able to move virtually without friction throughout the long axis of the sensor. The velocity of the rod magnet may be sensed by surrounding the cavity with a simple coil. The dimensions of the device, as well as the mass of the rod magnet, may be adjusted to achieve specific performance goals.

This technique performs very well as an open-loop geophone where the frequency range is between 4 Hz and several hundred Hz. When used in the vertical mode, an additional magnet is placed external to the device to oppose and levitate the proof mass to a central position. This sensor is very rugged and hard to damage due to the lack of mechanical suspension components. Typical distortion performance is shown below.



It is likely that if this device were configured as a force feedback sensor, the frequency range could be extended to very low frequencies while maintaining very low distortion. Sensing only the velocity change with a coil and forcing it to zero with feedback from a second coil could create a sensor which is not sensitive to the mechanical stability problems of position sensing components. Noise of this device could also be very low.