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designapplications

From the regional editors

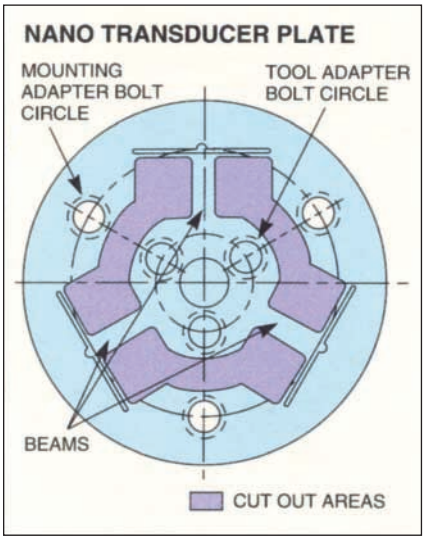
Tiny Sensors Assist Medical and Robotic Research

Small units fit into tight spaces

Robert Boggs, Southern Technical Editor

Garner, NC—Dental researchers wanted to measure bite force and direction. Robotic engineers wanted force and torque measurements on the fingers of a robotic glove. Prosthetic developers wanted accurate force figures on wrists, fingers, and toes. Rehabilitation researchers wanted to measure the progress of patients under therapy. An employer with workers at risk for Carpal Tunnel Syndrome needed a way to monitor the problem.

All these folks, and others, found what they needed in two new sizes of F/T (force/torque) instruments from Assurance Technologies, Inc. that function as sensors and transducers. Force/torque sensors measure both force and torque simultaneously in the x, y, and z axes.



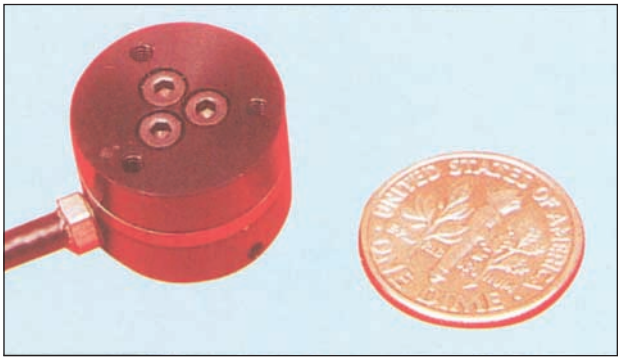
Silicon strain gages, mounted on all four sides of each beam, provide the force and torque values for the orthogonal axes. Nano sensor plate (shown) measures 0.669 inch in diameter and 0.0700 inch thick. Mounting and tool adaptor plates increase the thickness of the sensor to 0.57 inch.

Both the Mini and Nano sensors are scaled-down adaptations of the three-beam, six-axis Gamma unit (see DN 1-20-92. page 114). Outside diameter of the Gamma unit is 2.9 inches, the Mini measures 1.57 inches, and the Nano is 0.67 inch—smaller than a dime.

These small units use the same basic three-beam configuration as their larger sibling. This similarity of design does not mean, however, that the scale-down was just a matter of dividing dimensions by the ratio of diameters. For example, the Gamma unit includes a PC board that carries the amplifying and multiplexing electronics. To help shrink the Minis and Nanos, engineers place the board in a separate box at the end of a 71-inch cable. From there, the multiplexed signal goes to the F/T controller that resolves the six axes of force/torque information.

Larger units use overload pins to protect the sensing mechanism from massive overloads. Because the small versions do not have room for pins, engineers use sensors that are EDM-wire-cut from 13-8 VAR stainless steel with a yield strength of 205 ksi. Maximum allowable overload values are six to eight times rated capacities.

All of the unites employ silicon strain gages, but the smaller ones use much different proprietary mounting techniques. “I don’t think we will try for a device smaller than the Nano,” says Bob Little, mechanical product manager. “Attaching those 12 tiny gold-filament wires is not easy.”



Nano sensor/transducer fee ds signals through its multiplexing box to a Force/Torque controller that resolves six axes of data.

Researchers find that the Nano sensor/transducer fits nicely into the restricted spaces available in dental research. It also fits into the fingers of gloves which investigators are working with in robotics, prosthetic design, and physical therapy.

A Mini sensor/transducer monitors workers at risk for Carpal Tunnel Syndrome. With the sensor mounted on a knife used for cutting up chickens, the unit records the force the worker applies. If and individual’s force reading decrease slowly over time, they may be indicating Carpal problems.

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