

Microsensor for tensile forces and stresses

Silicon strain gauges (Si-DMS) are highly sensitive and can also be miniaturized to an extreme degree. With chip edge lengths significantly less than one millimeter, they are capable of measuring forces and stresses in numerous applications. In addition to the sensor chip itself, the type of force-fit mounting and electrical contacting is a crucial issue, which is being solved at the CiS Research Institute using modern assembly and connection technology.

A sensor for determining the belt tension in transmission belts of drive systems based on Si-DMS was developed for the precise planning of maintenance intervals, early detection of material fatigue, and avoidance of unplanned downtime (predictive maintenance). The sensor system allows integration directly into the transmission belt, whereby a direct mechanical connection between the sensor and the belt is established. Contact and signal output are wired, and the system includes integrated mechanical protection of the sensors against external manipulation. Further advantages include the operating temperature range of -10°C to $+80^{\circ}\text{C}$, the maximum force range of up to approx. 40 kN (belt load capacity designed for up to 35.7 kN), and the high measuring range of the sensor signal of approx. 20 mV/V. The measurement deviation is approx. 1-2% FS at $T = 25^{\circ}\text{C}$ and 2-5% FS at $T = -10^{\circ}\text{C}$ to $+80^{\circ}\text{C}$. The preferred application is linear drives.

These results from the “ZugKraftSensor” funding project demonstrate the versatile applications of silicon strain gauge. The CiS Research Institute focuses on the development and manufacture of innovative silicon components with a high degree of manufacturing maturity and their integration into customer-specific solutions.

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Contact: Dr. Klaus Ettrich, kettrich@cismst.de

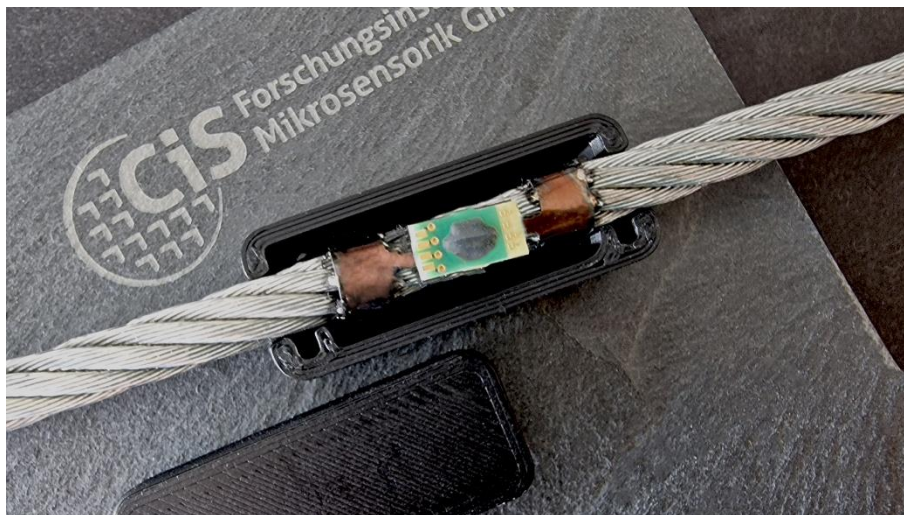


Image 1: Silicon strain gauge mounted on a steel cable as a tensile force sensor. © CiS

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