The principle and method for measuring changes in length with vibrating wire instruments was outlined in the introduction to chapter 3.

Specially for taking strain measurements on steel and concrete components and for embedding in concrete we install e. g. strain transducers system Glötzl/Maihak. In addition to measuring displacement or strain, the vibrating wire type of transducer can also be used to measure pressures and stresses or forces.

These instruments display the following characteristics:

- High measuring sensitivity (e. g. 3 x 10^{-4} or 2 x 10^{-3} of the measuring range)
- Possible remote transmission of measured values regardless of changes in resistance on the transmission routes
- Small insulation resistances (starting from 10 kOhms) are sufficient
- Instruments are simple and rugged in design
- Transducers are ready for installation, calibrated and waterproof
- Fully automatic measurement and logging possible

Fig. 1 Measuring sensor GFVM 250/0.5 for concrete strain measurements, based on the vibrating wire measurement process

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The measuring sensor GFVM 250/0.5 (Fig. 1) has a measuring length of 250 mm and is enclosed in a pressure-water-tight capsule. It is particularly well suited for taking measurements in concrete and coarse aggregates.

The sensors are embedded directly in concrete without needing to be surrounded in advance with a protective cylinder. The sensor housings are largely insensitive to bending. The coefficient of thermal expansion of the sensors is roughly equal to that of steel (11.8×10^{-6}). The shielded 2-conductor measuring cable is connected in the required length and sealed with a 2-component casting compound. The measuring wire has additional protection against water ingress.

Vibration wire sensors for welding or screwing in position are available to determine strains on steel component surfaces, e. g. tunnel arches. We have found the GFVM Type C steel strain sensor to be best in this connection. It can be fastened with either four weld-on threaded bolts size M 12 with hexagonal nuts for use on flat steel sections or with two weld-on adapters with four clamping screws size M 12 for use on concave structural steel parts. Its measuring length equals approximately 250 mm with a measuring range of approximately 2000 $\mu\varepsilon$.

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