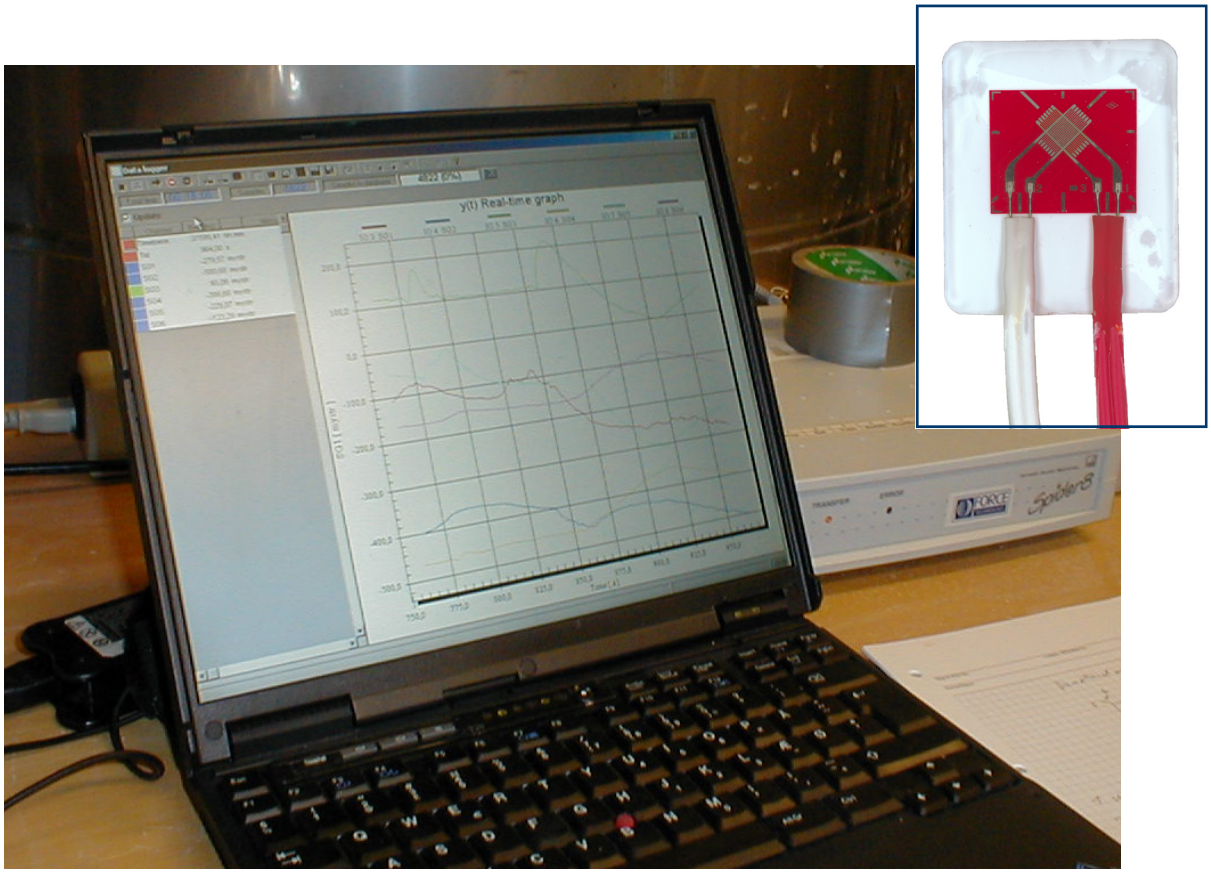
Precise measurement of stresses in dynamically or statically loaded structures

Strain Gauge Measurement



Measurement principle

In principle, a strain gauge is an electrical-resistance wire bonded to a backing sheet of foil. It is usually cemented onto the object to be measured. When the object is loaded, the gauge follows the deformation of the material, and its resistance changes in proportion to the deformation. The extremely small changes in the resistance in the gauge are recorded, and then used to determine the strain in the material.

Applications

Strain gauge measurements shed light on deformation, stresses and loads in just about any structure. Examples:

- Machines - also rotating parts
- Bridges
- Offshore structures
- Cranes
- Pressure vessels
- Concrete structures
- Prototypes of all kinds.

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Structural design

Characteristic of the development of structural designs is that, at some point in the design phase, computations have to be made to determine the strength of the various sections of the structure. Often, advanced software will be used in this connection employing e.g. the Finite Element Method (FEM). Only if all the assumptions - such as size of load, load frequency, and support conditions - are completely correct will such computations give a true picture of structural deformation and stress.

Once the structure has been erected, strain gauges placed at critical points in the structure can be used to monitor very closely whether the assumptions made were satisfactory or whether the computational model needs to be adjusted. Strain gauge measurements provide a solid basis for making changes to give the structure the desired lifetime, and so that future structures can be built as efficiently and economically as possible.

Fitness for purpose

Computational methods in modern fracture mechanics can be used to evaluate the fitness for purpose of defective structures, e.g. structures with welding defects. These methods require a precise determination of the type, size and location of such defects. This can be done using non-destructive test methods: ultrasound, eddy current, and others.

It is also necessary to know precisely the stresses in the defective areas. Strain gauge measurements are the most reliable non-destructive test method in this situation, and it should be used where there is uncertainty about the stresses.

Strain gauging results can be used to assess:

- Safety
- Remaining lifetime
- Mode of vibration
- Repair and reinforcement options.

Testing and documentation

FORCE Technology can perform:

- Static testing, such as is used in the certification of pressure vessels
- Dynamic testing - recording variations in load over time
- Wireless signal transfer - measuring rotary machine parts using telemetric equipment
- Testing with a friction gauge - a quick and economical test of stress variations
- Residual stress testing, e.g. checking results of stress-relief annealing
- Bolt tension testing - measurement of bolt preload.

FORCE Technology uses both analogue and digital equipment, which enables a rapid and precise data acquisition. Testing is performed by FORCE Technology engineers, who are then able to offer relevant analysis of the results if desired.

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