

Simultaneous determination of changes in resistance and temperature in bridge circuits

Background

Bridge circuits (bridges) are often used to determine a change in resistance, which represents a quantity to be measured. Their working principle is simple. They are therefore used in numerous applications, e.g. to determine physical parameters (in sensors for pressure, force, magnetic field via AMR/ GMR effect). As resistances and especially changes in resistance (respectively sensor effects) are temperature-dependent, it is necessary to know the temperature of the bridge in order to determine the measured variable as accurately as possible. The suppression of a possible offset of output voltages is also desirable.

Problem

There are various solutions for balancing and compensating temperature-induced offsets in circuits. Measuring errors can be reduced by adding temperature sensors, characteristic curves or calculation methods. However, these always require additional effort. In addition, knowledge of the temperature is important for condition monitoring in some applications.

Solution

The concept, which is based on conventional bridge circuits, allows the simultaneous calculation of resistance and temperature changes in a bridge circuit by combining different data, such as temperature coefficients (TC) and voltages of the bridge circuit. The method used describes two variants, with (1) or without (2) an additional resistor R_5 (see figure). A temperature sensor is not required. Both current and voltage sources can be used for supply, depending on certain conditions, such as resistance values or TC of individual resistors. Variants 1 and 2 are possible as full, half or quarter bridges. By means of a micro-controller, the pure change in resistance and also the temperature can be calculated simultaneously and accurately. An adjustment of the bridge circuit is not necessary.

Contact

Dipl.-Ing. Emmerich Somlo
TLB GmbH
Ettlinger Straße 25
76137 Karlsruhe | Germany
Phone +49 721-79004-0
somlo@tlb.de | www.tlb.de

Development Status

Concept / TRL2

Patent Situation

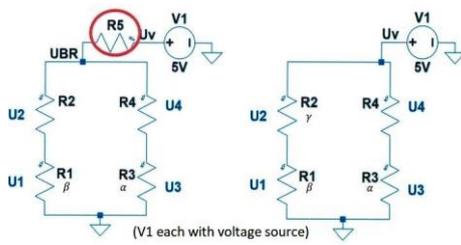
DE 102018216136A1 pending

Reference ID

17/101TLB

Service

TLB GmbH manages inventions until they are marketable and offers companies opportunities for license and collaboration agreements.



Circuit variants 1 (left) with and 2 (right) without resistor R5 [image: Karlsruhe University of Applied Sciences]

Advantages

- High-precision output signals of bridge circuits without additional temperature sensor
- Simultaneous determination of changes in resistance and temperature / ΔR and ΔT
- Immediate determination and compensation of temperature influence
- No adjustment of bridge circuit required
- Suitable for quarter, half and full bridges
- Suitable for current or voltage sources

Scope of application

At Karlsruhe University of Applied Sciences, a concept for evaluating bridge circuits was developed which enables the simultaneous determination of changes in resistance and temperature. This novel concept does not need any additional temperature sensors, because the bridge circuit is also used as temperature sensor – an advantage that is particularly beneficial for high accuracy requirements (such as in sensor technology).