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| Title:                  | **Wireless temperature sensing of fast rotating objects** |
Abstract:

1. Background, Motivation and Objective:

A surface acoustic wave (SAW) transponder system was developed to measure the temperature and optimize the heat flow within a continuously variable transmission (CVT) gearing of a combustion engine. Though no external trigger is used, temperature measurements on the rotating parts have been realized up to a rotational speed of 8.000 rpm.

Temperature sensing of fast rotating objects is needed to optimize temperature critical parts or to find the operational limit of certain components within high speed engines. SAW transponder systems are well suited for such sensing applications, as they can be interrogated wirelessly.

2. Statement of the Contribution/Methods:

In the paper a SAW sensing system for temperature measurement of fast rotating objects is described. The system was developed to measure the disk temperature of a CVT gearing. This temperature is critical due to possible heat transfer to the gear belt. The systems works without an external trigger and can be attached with minimal effort. The temperature of the disk was measured up to a rotational speed of the CVT disk of 8.000 rpm (Fig. 1). In the laboratory temperature measurements have been realized up to a rotational speed of more than 30.000 rpm.

Fig. 1: Measured temperature of the fast rotating CVT disk
3. Results/Discussion:

For a good thermal coupling the SAW sensor was directly attached to the CVT disk. Via a coaxial cable the radio frequency signal was transmitted from the SAW device to the transponder antenna, screwed onto the CVT gearing. All transponder parts have been locked with an epoxy adhesive, to ensure a good bond to the fast rotating gearing. A specialized transponder antenna was designed and matched to the metal surrounding and the SAW device to achieve a good sensor signal. Aspects of the system design and the measurement results are presented.