Speed Sensor

Objective

Based on a customer's requirements, the aim of this project was to develop a self supplied speed sensor. The choice was to design a tacho generator, with voltage and frequency proportional to the speed.
A contactless sensor has been developed and patented to measure the speed of a rotating cogwheel. This structure measures speed using variable reluctance principle. This speed sensor concept has convinced automotive industry due to its good performances and other advantages. Since it is based on low number of parts, its price is compatible with the market expectations for this application.

Structure

The device's architecture is mainly composed of a rotor and a stator. The rotor is made of a cogwheel turning at the speed you want to measure. The stator is composed of magnets, specific magnetic circuit and a coil in order to produce the magnetic flux variation and the signal.

When the cogwheel rotates, because of the tooth on stator and rotor, the device's reluctance changes and creates a flux variation, which induces an alternative voltage at the terminals of the coil.
The signal frequency and voltage depend on the rotor speed. The faster the rotor revolves, the higher the frequency and the voltage are.

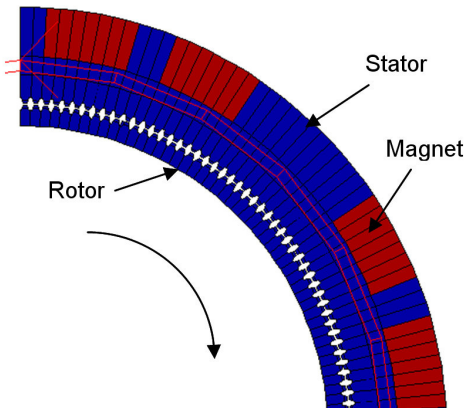

Figure 1: Speed sensor mechanical design

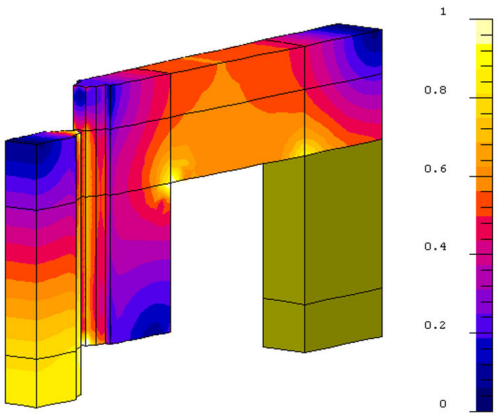

Figure 3: Isovalues of induction

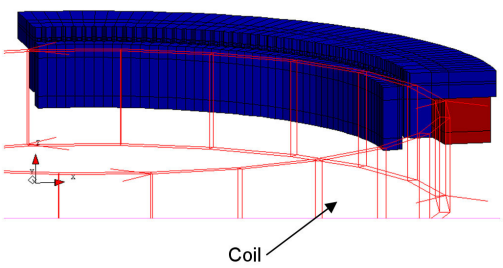

Figure 2: Speed sensor mechanical design

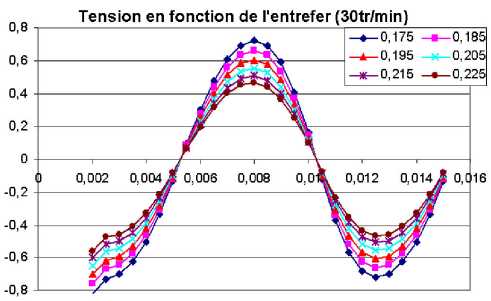

Figure 4: Voltage vs airgap

Speed Sensor

Performance

Figure 2: Frame with rotor and stator

Figure 4: Shaft with rotor and bearing

Characteristics	Unit	values
Material		Magnetic steel
Work Frequency	kHz	0,1 to 10
Speed	RPM	30 to 3000
Voltage	Vpp	1,5 to 30
Load	kΩ	3
Resistance windings	Ω	400 to 500

The structure's design and optimisation have benefited from the use of 3D finite elements modelling tools such as Flux®. It allowed speeding up the conception phase and reaching the targeted performances from the first try.

Applications

This sensor finds applications for classical speed measurement in automotive and aeronautic industries. Moreover, as this measuring device is also a generator, it allows to combine contactless speed measurement and the supply of high level electronics (other sensors as force sensors, accelerometers, strain gauges, signal treatment and conditioners, RF transmissions …) on rotating machine output shaft in a very large number of applications: Manufacturing machines, Machine tools, Electric motors, Spindle ...

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