

## **OO/UC3M/69 - INDUCTIVE SENSOR FOR MEASURING PARTIAL DISCHARGES IN ELECTRICAL MACHINES**

The research group 'Diagnosis of Electrical Machines and Insulation Materials (DIAMAT) of the University Carlos III of Madrid, has developed an inductive sensor that can detect and measure partial discharge that are characteristic in electrical machines (its analysis allows to estimate the aging degree of the internal insulation).

### **Description and special features**

The research group 'Diagnosis of Electrical Machines and Insulation Materials (DIAMAT) of the University Carlos III of Madrid, has developed an inductive sensor that can detect and measure partial discharge that are characteristic in electrical machines, which analysis allows to estimate the aging degree of the internal insulation.

The sensor can take real measures without galvanic contact with the tested machine, in situ and real operation without stopping the machine, which facilitates the advanced and scheduled maintenance. Furthermore, its low-cost design allows replacing expensive items used in traditional techniques.

Partial discharges are an unavoidable well known problem. They are current pulses of small amplitude and short duration, due to degradation or breakage of the insulating materials of lower dielectric strength, where the electromagnetic field is intensified.

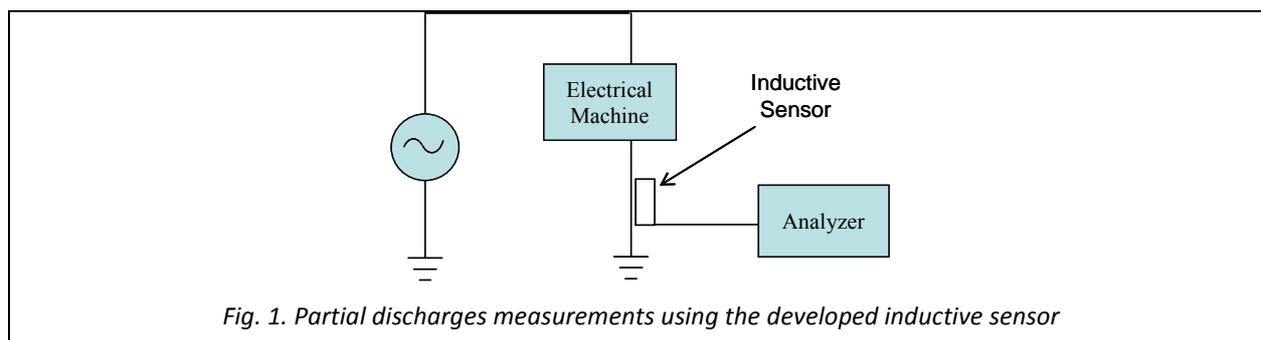
The developed sensor solves these problems, and it is a very effective and economical alternative. The design is based on inductive coupling of one or more coils arranged in the plane of the tested wire, either an internal wire or the power cord of the tested machine. The inductive coupling is inherent to the design, it has enough sensitivity and provides galvanic isolation to any measuring apparatus connected to the sensor.

Another advantage is its low cost and volume, so the sensor can be embedded on the machine even since its construction. Providing an external connection to the sensor, a measuring device may be connected when the electrical machine is running, without stopping it for making connections or transporting to a laboratory, which would alter the normal operation.

Continuous monitoring without service interruption is very attractive to analyze the operation in situ. This allows the anticipated and scheduled for less harmful times maintenance. In addition, this avoids the cost associated with unscheduled service interruptions when using other methods.

The electrical response of the sensor depends on three geometrical aspects: length, width and distance from the electrical machine wire. Its design allows the adaptation to different needs for bandwidth, frequency band and desired sensitivity.

Finally, it is noteworthy that the structure of the sensor performs effective filtering of the primary and secondary harmonics induced from the main power. So it is not needed a specific filter in the subsequent measuring apparatus.



### Innovative Aspects

- The sensor faithfully reproduces the waveform of the partial discharges with time resolution.
- It eliminates the galvanic contact with the measuring apparatus.
- It replaces elements of much higher cost and complex adjustments.
- It has reduced size and weight, and it is inexpensive.
- It can be embedded on the machine since its manufacturing.
- It allows tests in real time operation without service interruptions (avoiding the associated costs).
- It allows scheduling maintenance in those less harmful times.

### Competitive Advantages

The advantages for any company are in the improvement of maintenance processes and associated costs:

- It is not necessary to interrupt service.
- Monitoring can be continuous and in real operation, without transfer to the laboratory.
- The maintenance can be scheduled in those less harmful times of the service.
- The unscheduled service interruptions are less probable.
- The cost of the sensor is much smaller compared to other solutions.
- Its bandwidth is appropriate for new identification and diagnosis techniques being developed recently.

### Estado de la propiedad industrial e intelectual: Patent applied

- Spanish application: P200801174. Date: 23-04-2008. Title: "Sensor inductivo con aislamiento galvánico para la detección y medida de pulsos de corriente de alta frecuencia" ('Inductive sensor with galvanic isolation for detection and measurement of high frequency current pulses')
- PCT application: PCT/ES2009/070093. Date: 7/04/2009

### Palabras clave

Equipment, components and electronic circuits; Contracted systems and systems in real operation ; Methods and facilities of test/analysis; Electrical technology related to the accomplishment of measures

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