

Preliminary investigation on systems for the preventive diagnosis of faults on agricultural operating machines

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Introduction

Defects in rolling bearings leads to an increase in emission levels of noise and vibration. Monitoring bearing emissions, as an indication of wear, allows to manage a preventive maintenance of the machine components. The present research has the aim to investigate the main common failures in the rotary harrow. The work has been started with a questionnaire to workers who every day operate agricultural machinery, in order to keep some information about the failures that usually affect rotary harrows.

Then, in order to evaluate the optimum level of operating conditions for the bearings in agricultural machines, it has been monitored the emitted vibrations through a triaxial accelerometer fixed on the harrow structure. Over this optimum level a preventive maintenance is required.

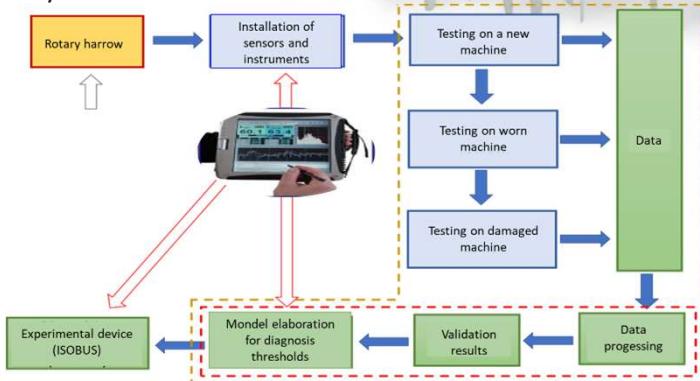
Materials and Methods

Measurements were made on each rolling bearing.

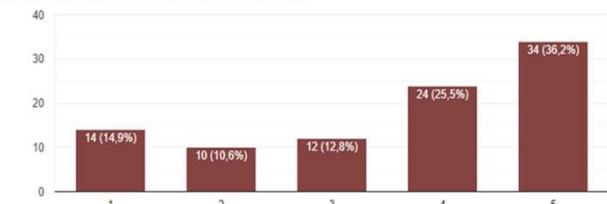
Sensor / support

The work was organized according to the following criteria:

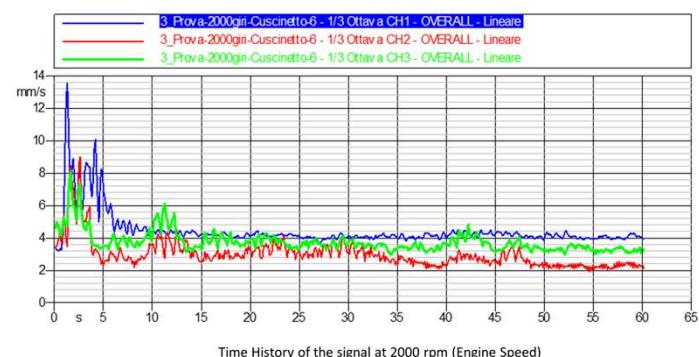
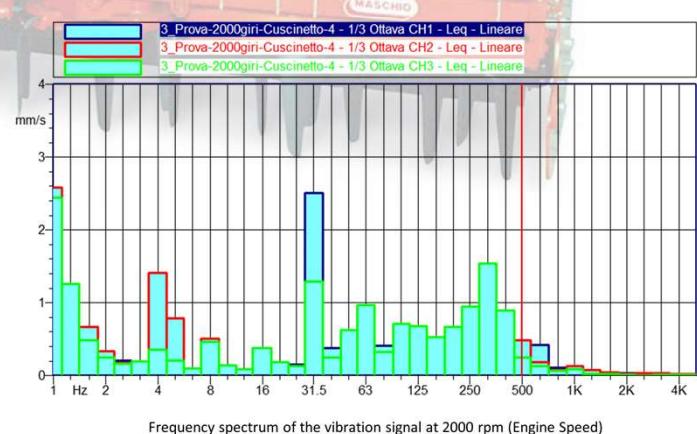
- analysis of the signal trend over time (Time History) to assess the presence of any anomalous component;
- analysis of the frequency spectrum (1/3-octave bands), to identify vibration sources.



On a scale of 1 (not at all useful) to 5 (fully useful), how important would it be for you to have on board a system that warns the driver in advance of a possible breakdown of the car (detect the first signs of deterioration of particular elements well in advance before actual failures occur)?



An experimental activity has been conducted on the rotary harrow under investigation, with the aim of identify the stress of each rolling bearing, considering the amplitude values and frequency spectrum of the vibratory signal. Each measurement has been repeated three times for each rolling bearing and has been carried out at different rpm of the tractor engine in order to obtain a standardized measurement method. It has been demonstrated a decrease of acceleration values along with the increase of rpm.



Results and Discussion

The results derived from the proposed questionnaire show that the failures on the rotary harrow occur at least one time per year. The favorable setting for the failure is represented by the rolling bearings or the tooth closer to the knives near the gearbox. When a failure occurs the average time needed for the repairing is around 2-3 days and the cost is about 900 euros. More than 60% of the interviewees showed a high level of agreement for the implementation of an on-board system for preventive maintenance on rotary harrow.

Conclusion

The results show different wear degree of the bearing due to the characteristics of mechanical transmission from the PTO to each wheel cogged. Despite of many factors that influence the signal stability, the measurements showed an acceptable degree of accuracy. For the future, more kind of rotary harrows will be analyzed in order to generalize the behavior of damage occurring in rotary components.