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BACKGROUND TO CONDITION MONITORING AND FAULT DIAGNOSIS DIESEL ENGINE

The traditional method of condition monitoring was carried out using manual inspection, relying on the expertise of a technician to monitor and check the engine performance. For example, when the technician observes a reduction in the generated power, he will undertake a sequence of inspections which may involve measuring the off-line cylinder compression pressure. A reduction in the peak pressure might indicate leakage from the cylinder which could be attributable to damaged valves, rings, or cylinder head gasket. To ascertain the specific fault it will then be necessary for the technician to dismantle the cylinder head and inspect the condition of the internal parts. By introducing continuous on-line condition monitoring, it is possible to measure the condition and performance of the diesel engine whilst it is running. At the same time, measurements can identify when it is necessary to renovate or replace engine parts. This measurement data could therefore be uploaded to an automated system that evaluates the engine condition and can predict the possible fault cause and level.

Many researchers and manufacturers have paid close attention to developing a variety of fault diagnosis methods or systems. Among these, the researcher's effort is focused on robust and economic condition monitoring and fault diagnosis systems for the overall diesel engine or a specific subsystem. Most of the engine condition monitoring and fault diagnosis systems that have been reviewed are based on off-line testing and analysis. Since the 1980s, many scientists and researchers have developed models using knowledge based diagnostic reasoning that can solve various types of problem. Conventional models have bottlenecks, such as knowledge acquisition, complexity, and required a large knowledge base. Recently researchers have carried out considerable work using a diagnostic approach based on neural networks, fuzzy logic, or a combination of the two. Because of its high compatibility with non-linear complex systems, the neural network was selected for the proposed engine condition monitoring and fault diagnosis system. In addition, neural networks offer a promising solution that can mimic the human information processing capability. Fuzzification, which is only part of the fuzzy logic structure, was utilized to develop a simple output that gives the user a simple recommended action.

A data acquisition system has been constructed to collect information using appropriate sensors on an existing four cylinder Ford 4-stroke diesel engine. The collected information is used to monitor the engine condition as well as detect any changes that may develop and cause a mechanical fault or reduction in performance.

The acquired data was used to construct a Neural Network algorithm that can evaluate the engine condition and detect a fault before it develops to a severe level. A review of previous research in this field shows that the most suitable neural network architectures for the non-linear system are the Radial Basis Function (RBF) and Multi-Layer Perceptron (MLP). A comparison between the two topologies was carried out to evaluate the optimum architectures for the diesel engine application, with the aim of minimizing the number of sensors for the condition monitoring and fault diagnosis system algorithm. This was evaluated by only using the key parameters that is able to detect and evaluate the engine condition and possible faults.

The neural network accuracy depends primarily upon the amount of available data. However, to increase the testing regime an analytical engine model has been constructed using the chemical, thermodynamic and dynamic mathematical relationships that govern the different engine processes. This model was verified and then utilized to investigate the effect of various changes in the engine parameters, as well as being used to generate another set of data for evaluating the condition monitoring and fault diagnosis algorithm. The proposed model was constructed using general relationships that can be adopted to suit high speed medium size diesel engines.

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ВИКОРИСТАННЯ КУРСОПОКАЗЧИКІВ В СИСТЕМІ ТОЧНОГО ЗЕМЛЕРОБСТВА

Ми живемо в аграрній країні, тому постійно постає треба розвивати аграрний сектор. Триває епоха інновацій, які інтегруються в усі сфери життя, в тому числі й сільське господарство. Вже сьогодні на поля виїхали електротрактори. Вони вирішать проблеми паливних ресурсів та забруднення навколишнього середовища.

В системі точного обробітку ґрунту також свої інновації: це, перш за все, застосування супутникової навігаційної системи в процесі управління сільськогосподарськими машинами.

Система паралельного водіння дозволяє більш ефективно використовувати передову широкозахватну техніку, проводити нічні польові роботи під час обприскування культур, знизити дію людського фактора, коли від уміння механізатора залежить врожайність.