

MAGNETIC FLUX LEAKAGE SYSTEM FOR WIRE ROPE INSPECTION  
USING BLUETOOTH COMMUNICATION

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## ABSTRACT

A wireless data communication Magnetic Flux Leakage (MFL) system for steel wire rope cable inspection has been designed and constructed to facilitate the remote data transferring. The system incorporates permanent magnets and Hall Effect sensor arrays, with its signal processing circuit and data acquisition system. Strong permanent magnetic discs of about 1T are used to magnetize the cable. Hall Effect sensors are arranged in parallel to detect the leakage flux from different angles. The system is battery operated, which is three units of AA batteries function as a power source. Another three units of AA batteries can also be fitted in as the backup power supply. The wireless data communication system has been constructed using Bluetooth module. The signals are digitized using an Emant380 Bluetooth data acquisition module consist of six channels of differential multiplexed analog-to-digital converter, and the data can be stored in computer or Smartphone's memory. Python programming language is used to collect and interpret the data in a graphical form. This system use Tkinter graphical user interface toolkit for the computer while HTML is a platform for full screen user interface display on Smartphone. The screen displays the location and the flaws signal. System was tested and evaluated on various simulated wire rope defects of different depth and width, ranging from 2 mm to 6 mm depth and 1 mm width and also 2 mm to 6 mm width and 2 mm to 3 mm depth. This system has a relatively high sensitivity for the detection of magnetic flux leakage through defects with a depth of 2 mm and 1 mm wide.

## ABSTRAK

Sistem pemeriksaan kebocoran fluks magnet (MFL) komunikasi data tanpa wayar untuk pemeriksaan kabel dawai keluli telah direka dan dibina untuk membolehkan pemindahan data jarak jauh. Sistem ini menggabungkan magnet kekal dan susunan penerima Kesan Hall, lengkap dengan litar pemprosesan isyarat dan sistem pemerolehan data. Cakera magnet kekal dengan kekuatan 1T digunakan untuk memagnetkan kabel. Penerima Kesan Hall disusun secara selari untuk mengesan kebocoran fluks dari sudut yang berbeza. Sistem ini beroperasi menggunakan tiga unit bateri AA berfungsi sebagai pembekal kuasa. Tiga unit bateri AA yang lain boleh juga digunakan sebagai bekalan kuasa sokongan. Sistem komunikasi data tanpa wayar telah dibina menggunakan modul Bluetooth. Isyarat didigitkan menggunakan modul pemerolehan data Emant380 Bluetooth enam saluran multipleks berbeza penukar analog-ke-digital, dan data disimpan di dalam memori komputer atau telefon pintar. Bahasa pengaturcaraan Python digunakan untuk mengumpul dan mentafsir data dalam bentuk grafik. Sistem ini menggunakan perkakasan antara-muka pengguna grafik Tkinter bagi komputer manakala HTML sebagai antara-muka pengguna pada platform paparan skrin penuh telefon pintar. Skrin memaparkan lokasi dan isyarat kecacatan. Sistem telah diuji dan dinilai pada berbagai simulasi kecacatan kabel dengan kedalaman dan lebar pembeza masing-masing pada julat kedalaman 2 mm hingga 6 mm dan 1 mm lebar serta pada julat 2 mm hingga 6 mm lebar dan kedalaman 2 mm hingga 3 mm. Sistem ini mempunyai kepekaan yang tinggi bagi pengesanan kebocoran fluks magnet melalui kecacatan dengan kedalaman 2 mm dan 1 mm lebar.