DESIGN OF AN ACOUSTIC EMISSION ROBOT USED FOR PRELIMINARY DETECTION OF SHAFT INTERNAL CRACKS

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ABSTRACT

A shaft crack is a fracture or discontinuity in a rotating shaft caused by fatigue, stress concentration, or material defects. Cracks typically begin on the surface and spread inwards. Shaft cracks are extremely dangerous in rotating machinery. Because a small, undetectable defect can develop into a complete shaft fracture within hours or days, leading to serious equipment failure. Detection of internal cracks in solid shafts is generally performed using non-destructive testing methods (Ultrasonic, magnetic particle, and radiographic testing) that do not compromise the integrity of the material. Hammer testing is another practical and traditional non-destructive testing method often used to detect material integrity, cracks, or loose connections. When a non-defective solid shaft is struck with a hammer to detect cracks, a clear, ringing sound is produced. If there are cracks in or on the shaft, the sound will be muffled, or the vibration will be dampened. In the present study, crack detection within a solid shaft is performed by measuring the sounds produced by four 20 mm diameter steel balls freely falling onto the shaft from a distance of 365 mm using a decibel meter. The semi-automatic robot[1] was developed as an alternative to the hammering method for the preliminary detection of cracks. The surface areas to be tested by the steel balls can be varied using a DC motor-driven screw shaft system. Experimental results have demonstrated that the robot can produce rapid results per unit length, is improvable, and can reduce maintenance costs.

Keywords: Solid Shaft, Acoustic Emission Robot, Hammering, Crack Detection, Echo Listening, Screw Shaft.

[1] This study was carried out with the support of the Çukurova University Scientific Research Projects Unit (Project code: FBA-2023–16425).