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Numerical Simulation of Pulse Laser-Generated Ultrasonic Wave and Amplitude Peak Count for Defect Detection

By [Ab Wahab, N](#) (Ab Wahab, Nazirah) ^[1] ; [Andan, AD](#) (Andan, Amelda Dianne) ^[2] ; [Yusof, NM](#) (Yusof, Nurhalawa Md) ^[3] ; [Sony, C](#) (Sony, Chindada) ^[4]

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Abstract

High spatial resolution and the possibility for distant and noncontact measurements have led to substantial research into laser ultrasonic techniques. Pulse lasers produce heat when the surface of a target object absorbs its electromagnetic energy. When a material undergoes a temperature shift, it generates stress and strain fields, which in turn cause an elastic wave known as ultrasound. This research simulated the effects of an ultrasonic wave produced by a laser striking an aluminium plate. Using extremely fine meshes, the pulse laser stimulation is modelled as a localised heat flux imposed to the structures' surface. The 2D simulation data for intact specimen is collected and then compared to an existing experimental data using contactless laser ultrasonic measuring equipment. The model is then subjected to surface damage and identified using a threshold to retrieve the peak count from the laser ultrasonic data while analysing the correlation between damage effects found in various locations and peak counts. The total number of peak counts is measured, and the damage is successfully detected. Based on the identified peak counts, different damage locations can be determined and analysed.

Keywords

Author Keywords: [Laser ultrasonics](#); [finite element method](#); [damage localization](#); [peak count](#)

Author Information

Corresponding Address Ab Wahab, (corresponding
: Nazirah author)

▼ Univ Teknol MARA, Fac Civil Engn, Shah Alam 40450, Selangor, Malaysia

E-mail Addresses :

nazirahwahab@uitm.edu.my

Addresses :

▼ ¹ Univ Teknol MARA, Fac Civil Engn, Shah Alam 40450, Selangor, Malaysia

▼ ² Int Islamic Univ Malaysia, Dept Mech & Aerosp Engn, Kuliyah Engn, Gombak 53100, Malaysia

▼ ³ Natl Metrol Inst Malaysia, Elect Grp, Acoust Ultrasound & Vibrat, Sepang 43900, Malaysia

▼ ⁴ CAS, Inst Thermomechan, Dolejskova 1402-5, Prague 8, Czech Republic

E-mail Addresses :

nazirahwahab@uitm.edu.my