

**EXPERIMENTAL STUDY OF ACOUSTIC EMISSION TECHNIQUE FOR
CONCRETE DEFECT DETECTION**

HEADER ALI A.

UNIVERSITI TEKNOLOGI MALAYSIA

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of the requirements for the award of the degree of
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To Family

*“To my beloved family, especially my parents, brothers and sisters for supporting me
all the way”*

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ABSTRACT

The process of structural health monitoring (SHM) involves monitoring a structure over a period of time using appropriate sensors, extracting damage sensitive features from the measurements made by the sensors and analysing these features to determine the current state of the structure. Various techniques are available for structural health monitoring of structures and acoustic emission (AE) is one technique that is finding an increasing use. Acoustic emission waves are the stress waves generated by the mechanical deformation of materials. AE waves produced inside a structure can be recorded by means of sensors attached on the surface. Analysis of these recorded signals can locate and assess the extent of damage. This project describes studies on the AE technique for health monitoring of concrete structures. Crack initiation or structural damage will result in wave propagation in solid and this can take place in various forms. Propagation of these waves is likely to be affected by the dimensions, surface properties and shape of the specimen. This, in turn, will affect source localization. Various laboratory test results will be presented on source localization, using pencil lead break tests. The results from the tests can be expected to aid in enhancement of knowledge of acoustic emission process and development of effective concrete structure diagnostics system.

ABSTRAK

Proses pemantauan kesihatan struktur (SHM) melibatkan pemantauan struktur dalam tempoh masa dengan menggunakan sensor yang sesuai, mengekstrak ciri-ciri sensitif kerosakan dari ukuran yang dibuat oleh sensor dan menganalisis ciri-ciri ini untuk menentukan keadaan semasa struktur. Pelbagai teknik boleh didapati untuk pemantauan kesihatan struktur bagi struktur dan pancaran akustik (AE) adalah salah satu teknik yang semakin meningkat penggunaannya. Gelombang pancaran akustik adalah gelombang tegasan yang dihasilkan oleh perubahan bentuk mekanikal bahan. Gelombang AE yang dikeluarkan dalam struktur boleh dirakam melalui sensor yang dipasang di permukaan. Analisis isyarat yang direkodkan ini boleh mengesan dan menilai tahap kerosakan. Projek ini menerangkan kajian tentang teknik AE untuk pemantauan kesihatan struktur konkrit. Permulaan retak atau kerosakan struktur akan menyebabkan perambatan gelombang dalam pepejal dan ini boleh berlaku dalam pelbagai bentuk. Perambatan gelombang ini berkemungkinan terjejas oleh dimensi, ciri-ciri permukaan dan bentuk spesimen. Ini seterusnya, akan memberi kesan kepada penyetempatan sumber. Pelbagai keputusan ujian makmal akan dibentangkan tentang penyetempatan sumber, dengan menggunakan ujian patah mata pensil. Keputusan dari ujian boleh dijangkakan untuk membantu dalam peningkatan pengetahuan proses pancaran akustik dan pembangunan sistem diagnostik struktur konkrit yang berkesan.