



Damage detection methodologies for various structural members using the characteristics of ultrasonic waves

Speaker: Dr. Lee, Changgil
Korea Railroad Research Institute

Recently, there has been an increasing demand in using Structural Health Monitoring (SHM) and Non-Destructive Testing (NDT) techniques for continuous monitoring of civil infrastructures, aging aerospace vehicles and mechanical equipment to prevent structural failure such as crack, bolt loosens and fatigue failure due to excessive vibration, external impact, varying temperature and so on. Accordingly, many researchers have been proposed SHM/NDT techniques based on various sensing technologies. Common SHM/NDT techniques can be classified into two categories: i) Global monitoring system that static and/or dynamic behavior of structure is investigated using static and/or dynamic responses of the structure, ii) Local monitoring system to detect damage on the local area of the structure. Local monitoring methodologies are currently studied because incipient damage can be hardly detected based on the global monitoring system. Local monitoring approaches can investigate structural systems based on various features extracted from the local behaviors of structures. In this study, NDT methodologies based on the characteristics of ultrasonic waves are researched. First, the NDT technique using piezoelectric sensor measures E/M impedance and guided waves of target structures and this is contact-type NDT system. Using the poling characteristics of the piezoelectric sensors, specific modes of the guided waves can be decomposed and damage-sensitive features can be extracted. A multi-mode sensing system is proposed by integrating the E/M impedance responses with the guided waves. Statistical pattern recognition is applied to evaluate damage indices. Next, propagating ultrasonic waves were visualized by utilizing a laser scanning system. Then, flaw images can be obtained from the visualized waves by wavenumber filtering and calculating RMS(Root Mean Square) of the wave propagation images. To verify the feasibility of the proposed laser system, plate-like structures and a pipeline were tested.