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Nondestructive Evaluation of heterogeneous materials using
acoustic emission and ultrasound

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Heterogeneous materials as Composites and concrete are advantageous as structural components in many applications. However, damage detection in such materials is difficult due to their heterogeneity and anisotropy. Furthermore, conventional non destructive technique as X-radiographic is mostly not very sensitive to early damage and very time consuming and expensive. The purpose of this contribution is to study the capabilities of several methods, non destructive and very sensitive for damage characterisation, as Acoustic Emission (AE) and ultrasonic for the structural health monitoring of heterogeneous materials as polymer based composite materials and concrete. These materials are instrumented by piezoelectric sensors in order to detect acoustic emission and to measure the ultrasonic velocity. The mechanisms of the damage events and their space-time localizations are identified from AE. Simultaneously, the longitudinal ultrasonic velocity is measured in situ by transmission through the composites thickness. The AE is very well correlated with the loss of stiffness determined from ultrasonic velocity measurements showing the potentiality of this combined approach for in situ structural health monitoring.