Title

Kinematics of Tensile Failure and Cracking Mechanisms in Fiber-Reinforced Concrete by Acoustic Emiss...
Concrete is the oldest and most ubiquitous man-made material. As a very versatile construction material, it offers many advantages compared to other construction materials. However, it still poses fundamental problems and questions for academics and engineers because it often deteriorates especially cracked over time for many reasons. Consequently, it needs a real-time and non-destructive method to monitor, predict, analyze and clarify the failures processes so that it could reveal the hidden defects leading to structural failures long before a collapse occurs. Acoustic emission (AE) technology is one of the many available methods which offer the ability to infer material conditions and to monitor the structural integrity in an efficient way.

In this dissertation, the application of the one of the most advanced and sophisticated technique, namely AE-SiGMA analysis, to split-tensile tests of fiber-reinforced concrete (FRC) is aimed and kinematics of tensile failure and cracking mechanisms in FRC are clarified.

Results show that the failure mechanisms in SiGMA analysis are considered as similar in normal concrete and FRC, as micro-cracks are initiated at the contact between the specimen and loading plate, and in the diametrical section they propagate to the center of the specimen. After the maximum tensile stress is reached, the specimen is split apart. Thus, based on AE activities, cracking mechanisms are divided into three stages. Concrete microstructure greatly influences fracture formation. In this respect, the addition of fibres shows a significant influence to the crack evolution process on the self-healing effect. Because of high stiffness of SFRC of steel fibers, the opening vector might result in a difficulty to be healed, due to fairly large gaps at the cracking surface while in PVAFRC of poly-vinyl-alcohol fibers, the sliding vectors at crack surface are
dominant because the stiffness to shear stress is lower than of SFRC. Thus concerning the self-healing effect it could be conclude that, PVAFRC give significant contribution to good bridging between the cracking gaps which suggests that the formation of self-healing products plays an effective role due to tight spaces across fibres.