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Quantitative Structural Health Monitoring of Composite Materials

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Fibre Reinforced Composites (FRCs) are extensively used for manufacturing high-value structural engineering components. The complex damage mechanisms affecting such materials and the difficulty in inspecting them with traditional non-destructive testing (NDT) methods increases the need for effective Structural Health Monitoring (SHM) systems. SHM can evaluate FRC components in real time while they are in service, reducing downtime and minimising the risk of unexpected catastrophic failure. In this study, we report on the development of a customised acoustic emission system (AE) which is capable of capturing the full waveform and subsequently analyse it using various algorithms. Through this novel approach the identification, characterisation and quantification of damage initiation and evolution has been assessed on FRC coupon samples during tensile and flexural testing. Moving RMS has been one of the algorithms exploited for identification and quantification of damage during loading to failure of the tested FRC coupon samples. From the results obtained it has been possible to detect and quantify damage initiation and evolution through the identification of key events, including delamination, in the samples tested.