

Eddy current directional probe for in-line monitoring of Automated Fibre Placement manufacturing

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Despite the numerous attempts towards in-line monitoring of composite parts during the automated composite layup process, effective in-line inspection has yet to be met by standard non-destructive evaluation (NDE) methods. Current inspection processes are heavily reliant on visual methods which are highly subjective and limited to detecting only top surface defects. To reliably monitor the quality of Automated Fibre Placement (AFP) carbon fibre reinforced polymer (CFRP) tapes, a directional eddy current (EC) probe is tested as a function of varying AFP process parameters. This paper presents experimental results incorporating the proposed probe into an AFP head to detect in-plane waviness under varying AFP process parameter conditions such as compaction pressure, heating and deposition rate, and discusses the inspection capability and application challenges. Sensitivity assessment is performed to evaluate different probe configurations for the detection of sub-surface in-plane waviness during AFP manufacturing. The results indicate that the proposed probe design is capable of in-line detection of the targeted manufacturing defect type. The sensor has the potential to be employed for in-line monitoring of out-of-plane and in-plane wrinkles in automated composite manufacturing and demonstrates the reliability of the probe to detect the target defect with excellent signal-to-noise ratio (SNR) over coherent structural noise.