

Development in Automated Defect Detection for Fluorescent Penetrant Inspection using Machine Learning

---**N. J. Shipway**¹, P. Huthwaite¹, M. J. S. Lowe¹, and T. Barden²; ¹Imperial College London, Exhibition Road, London SW7 2AZ, United Kingdom; ²Rolls-Royce plc, 62 Buckingham Gate, London SW1E 6AT, United Kingdom.

Fluorescent Penetrant Inspection is a well-established and widely used NDE method. It involves applying a fluorescent dye to the surface of a component. The dye penetrates any surface breaking defects making them visible when excess dye has been removed. Whilst automated processing has been common in industry for a number of years, inspection is still performed manually meaning results are highly influenced by human factors.

Last year, the use of Random Forest to perform Automated Defect Detection for Fluorescent Penetrant Inspection (FPI) for the aerospace industry was presented. Results demonstrated that even with a small number of training examples, Machine Learning technique Random Forest is capable of detecting defects, as small as 0.7mm from dye associated with false indications, such as poor wash-off or geometrical indications, without an excessive number of false calls. The results of the Random Forest study were particularly encouraging because the method is open to a variety of differences in detail in its implementation, and this first study was done without attempting to tune the process. The presentation will cover continuing work to improve the performance of the automated classification, including studies of performance-based variants of the Random Forest.

Progress over the past year has also been in the development of Deep Learning techniques to perform the same task of defect detection for FPI. These results shall also be presented.