

Development of the real-time winding angle measurement device for the laboratory-scale 3-axis winding machine

Quanjin Ma^{a,b}, M.R.M. Rejab^{a,b}, O. Azman^a, S.A.A. Aleem^a, N.A. Tung^a, S.K. Asan^a, S.R.A. Rahim^a, A.Praveen Kumar^c

^a Structural Performance Materials Engineering (SUPREME) Focus Group, Faculty of Mechanical & Automotive Engineering Technology, Universiti Malaysia Pahang, 26600 Pekan, Pahang, Malaysia

^b School of Mechanical Engineering, Ningxia University, 750021 Yinchuan, China

^c Department of Mechanical Engineering, Easwari Engineering College, Chennai, India

ABSTRACT

It is well-known that an automatic system can reduce errors to a great extent, which increases productivity and reduces labor costs. The existing filament winding machines or equipment lack the winding angle detection or measurement system, which cannot provide high precision and stable winding angle. This paper proposes a real-time winding angle device that can detect and measure the fiber orientation of filament wound composite products. The real-time winding angle measurement system consists of an Arducam 5MP OV5647 camera and OpenCV software. It is developed as the programming function for processing the real-time image of the winding angle. Furthermore, the traveled movement slider and the winding angle measurement image can be acquired during the dry/wet process. The laboratory-scale 3-axis winding machine integrated with the real-time winding angle measurement device is successfully developed, assembled, and tested.

KEYWORDS

3 axes; Fiber orientation; Filament winding; Laboratory-scale winding machine; Real-time device; Winding angle

ACKNOWLEDGEMENTS

The authors would like to acknowledge the Faculty of Mechanical & Automotive Engineering Technology, Universiti Malaysia Pahang for funding this research: RDU1901126. This research work is strongly supported by the Structural Performance Materials Engineering (SUPREME) Focus Group.