World Academy of Science, Engineering and Technology
International Journal of Materials and Textile Engineering
Vol:10, No:12, 2016

Energy Efficiency Approach to Reduce Costs of Ownership of Air Jet Weaving

Authors : Corrado Grassi, Achim Schröter, Yves Gloy, Thomas Gries

Abstract : Air jet weaving is the most productive, but also the most energy consuming weaving method. Increasing energy costs and environmental impact are constantly a challenge for the manufacturers of weaving machines. Current technological developments concern with low energy costs, low environmental impact, high productivity, and constant product quality. The high degree of energy consumption of the method can be ascribed to the high need of compressed air. An energy efficiency method is applied to the air jet weaving technology. Such method identifies and classifies the main relevant energy consumers and processes from the exergy point of view and it leads to the identification of energy efficiency potentials during the weft insertion process. Starting from the design phase, energy efficiency is considered as the central requirement to be satisfied. The initial phase of the method consists of an analysis of the state of the art of the main weft insertion components in order to point out a prioritization of the high demanding energy components and processes. The identified major components are investigated to reduce the high demand of energy of the weft insertion process. During the interaction of the flow field coming from the relay nozzles within the profiled reed, only a minor part of the stream is really accelerating the weft yarn, hence resulting in large energy inefficiency. Different tools such as FEM analysis, CFD simulation models and experimental analysis are used in order to design a more energy efficient design of the involved components in the filling insertion. A different concept for the metal strip of the profiled reed is developed. The developed metal strip allows a reduction of the machine energy consumption. Based on a parametric and aerodynamic study, the designed reed transmits higher values of the flow power to the filling yarn. The innovative reed fulfills both the requirement of raising energy efficiency and the compliance with the weaving constraints.

Keywords : air jet weaving, aerodynamic simulation, energy efficiency, experimental validation, weft insertion
Conference Title : ICTCME 2016 : International Conference on Textile Composites, Materials and Engineering
Conference Location : Sydney, Australia
Conference Dates : December 15-16, 2016