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ONLINE ISSN: 1880-1986 PRINT ISSN: 1346-8235

Journal of Textile Engineering

Vol. 52 (2006), No. 2 73-79



Characteristics of Incompressible Air Flow in an Interlacer

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(Received March 28, 2005) (Accepted for publication November 15, 2005)

Abstract: The present study is concerned with numerical simulation of air flow in a yarn duct of an interlacer, which is an apparatus for yarn intermingling. A nozzle of circular pipe of inner diameter d(<D) is mounted perpendicularly to the varn duct of circular pipe of inner diameter D and length L. The air is injected from the nozzle into the yarn duct. This complex incompressible air flow of the interlacer system is analyzed by a numerical calculation program, FIDAP, using the high Reynolds number k- ε model. The air flow in the yarn duct can be simulated well by this analysis for $d/D \le 0.5$. For $d/D \le 0.75$, however, the predicted results for air flow in the yarn duct are not in satisfactory agreement with the measurements. The effect of the value of d/D on the air flow in the yarn duct is discussed. It is clearly found that for $d/D \le 0.5$ the circumferential air flow along the inner wall of the yarn duct is dominant, while for $d/D \ge 0.75$ the axial air flow is dominant. The interlacer with 0.5 $\geq d/D \leq 0.7$ is usually used in the practical interlacing processing, where the condition of the air flow largely changes from circumferential to axial flow. Furthermore, the ratio d/D has no great effect on the flow in the yarn duct for $d/D \ge 7$.

Key Words: Interlacer, Air injection, Numerical calculation, High Reynolds number k- ε model, Incompressible air flow

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To cite this article:

Koichi MURAKAMI, Kenichi TOKUNAGA, Shinfuku NOMURA, Syunzo NAITO and Mikio ABE, J. Text. Eng., Vol. **52**, p.73 (2006) .

JOI JST.JSTAGE/jte/52.73

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