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Characteristics of Incompressible Air Flow in an Interlacer

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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 yarn 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 $d/D \leqslant 0.5$. For $d/D \leqslant 0.75$, 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 $d/D \leqslant 0.5$ the circumferential air flow along the inner wall of the yarn duct is dominant, while for $d/D \geqslant 0.75$ the axial air flow is dominant. The interlacer with $0.5 \geqslant d/D \leqslant 0.7$ 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 $d/D \geqslant 7$.

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

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