A STUDY ON TWISTED STRUCTURE AND BENDING PROPERTY OF 2-PLY MULTIFILAMENT YARN.

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Abstract

Bending rigidity (B_f) of single co-helix filament in single strand is theoretically derived in terms of helix angle of single strand before plying (α_s), plying helix angle (α_p), and the ratio of the distance to the helix filament from strand axis (r) to strand radius (a), for analyzing the bending behavior of 2-ply multi -filament yarn by strain energy method.

The model of 2-ply multifilament yarn was assumed, and the angle, ψ between single filament and single strand axis was derived in terms of α_s , α_p , $\frac{r}{a}$ and rotation angle of transverse (ϕ_2), considering the change of torsion in the single strand from 2-ply multifilament yarn model.

The obtained results are as follows.

1.The angle, ψ between single filament and single strand axis is derived as follows.

$$\psi = \tan^{-1} \left(\frac{\tan \alpha_s + \frac{r}{a} \sin \alpha_p \cos \alpha_p}{1 - \frac{r}{a} \sin^2 \alpha_p \cos \phi_2} \right)$$

The conclusions are as follows

The estimated torsional rigidity of single yarns can be calculated from the mean fibre diameter together with four correction factors and minimum torsional rigidity. Among these factors, the correction ones due to fibre diameter distribution and twist are most dominent. And the extent of contribution of interfibre friction to the torsional rigidity, C_5 was clearly analyzed by comparing the values between estimated and experimental torsional rigidity.

However, the torsional behaviors of the fibres in the yarn are seen to be more affected by interfibre friction compared to that of bending behavior.
This phenomena were well explained by experimental results measured by torque tester, i.e. by energy loss on the torsional hysteresis curve and coercive torsional couple.