ESTIMATION OF YARN TORQUE BY USING ENERGY METHOD

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When crimpy staple fibers are manufactured into a yarn, the process of twisting decrimps the fibres and assemblies them into a generally helical geometry. The relative importance of the strain energies of various fibre deformations in twisted yarn varies with the mode of yarn deformation. Mechanical analysis based on simple helical models have been carried out to predict the response of yarns to extension, bending, twisting and lateral compression of yarns. These theoretical treatments assume yarns to be non-intractive fibre structures wherein each fibre is a discrete component of the structure and the aggregate response of the aseembly is obtained simply by adding the separate contribution of the individual fibres. In general, as twisted yarn is subjected to tensile deformation, fibre tensile strain energy term completely dominates the other strain energy terms arising from the bending and torsional deformations of fibres. A further significant question to be resolved is the impracticability of applying a significant torque to a single yarn in the absence of an axial tension. In this research, 'shortest-path' hypothesis, which the equilibrium position of the fibre paths in the yarn subjected to extension is predictable is applied to calculate yarn torque, using the principle of virtual work. This theoretical yarn torque by numerical computer calculation is compared with experimental results.