Abstract
In this study, a modular nozzle design was developed in which the twist chamber diameter, injector diameter, injector angle and the number of injectors of the nozzle can be optionally changed without the need of conventional manufacturing methods. The developed modular nozzle was compared with conventional nozzles taking into account both experimental and numerical analysis results. Experimental performance tests were conducted on the yarn quality achieved using air twist, which is the subject of the application of the nozzle. In the experimental study, conventional nozzles with the same structural configurations were produced to determine modular nozzle performance. In all jet-ring yarn productions, the air pressure was set at two different values: 75 kPa and 125 kPa (gauge). Yarn hairiness, irregularity and imperfection tests were carried out using an Uster Tester 3. Tensile properties (percentage of elongation and tenacity measured as cN/tex) tests were carried out using an Uster Tensorapid. In the numerical analysis, an Ansys CFX 18.0 computational fluid dynamics program was used for both conventional nozzle and modular nozzle configurations. All parametric study configurations were set separately using an SST turbulence model. Comparing the flow parameters of yarn hairiness (CFD analysis), it was found that increasing vorticity or helicity real eigen values reduced yarn hairiness. Keywords SST, swirling flow, swirl number, jet-ring, nozzle-ring, air nozzle