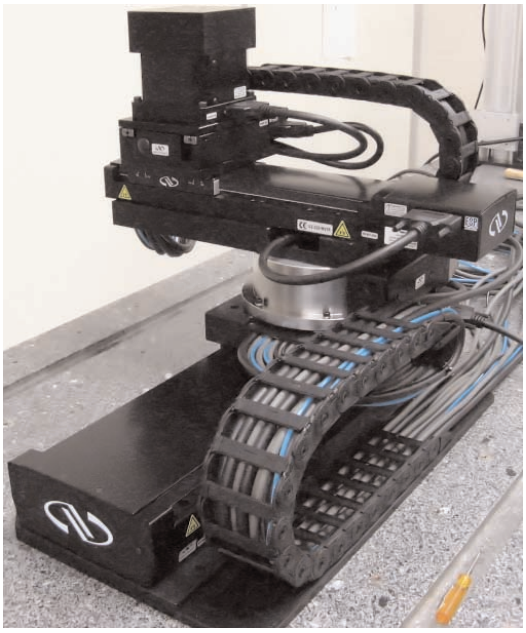
Fiber Spool Winding Application with Custom 5-Axis Motion System

Fiber optics cables are very delicate. The winding or packaging process requires great care unlike winding wire, cable or rope. In order to prevent twisting or breakage of the fiber, a high position sensitivity and velocity control is required in the winding operation. In demanding applications such as fiber optic gyroscopes (a coil of optical fiber that is used to detect rotation about its axis), it is necessary to minimize the mechanical stress imposed on the fiber to avoid the micro-bending loss which requires a sub-micron level of positioning resolution and accuracy. Newport motorized stages provide the ideal platform to meet the challenging requirement in this fiber winding application.

A Newport customer, who is a supplier of fiber components and instruments in the telecommunications industry, manufactures the special fiber spool for the fiber optics gyroscope development. Newport motion recently delivered a custom 5-axis motion system to enable the automation of an integrated optical fiber winding machine in the manufacturing process.



During the operation of fiber winding machine, the fiber from standard-sized spool (a few km length of fiber) is re-wound to a special compact spool device (a few hundreds of meters) which is mounted on Newport motion system. For each cycle, an empty fiber spool device is loaded on the stage stack, and the IMS300CC, moves the entire assembly from the loading position to the winding position. Afterwards, XYZ linear stage stacks (ILS200CC, GTS70 and GTS30V) along with RV rotary stage adjusts the final position of device to be aligned with the fiber spool. As the winding is completed, the spool is unloaded and the motion assembly moves back to loading position to start the next cycle.

There are several different types of fiber winding devices used at different loading positions, and the stage stack enables moving the load to the exact location in this automated process. The special spool device has an internal rotary motor for winding the fiber with continuous rotation, and it is connected to XPS controller via XPS-DRV00 pass-thru board. The XPS controller synchronizes the device rotation with the motion of 5-axis Newport motion system during the entire operation.

Key Specifications:

X1 Stage: IMS300CC - 300mm travel, 1.25µm resolution, 15µm on-axis accuracy

rZ Stage: RV160CCHL - 360° travel, 0.001° resolution, 0.010° absolute accuracy

Y Stage: ILS200CC - 200mm travel, 0.5µm resolution, 5µm on-axis accuracy

X2 Stage: GTS70 - 70mm travel; 0.05µm resolution; 2µm On-axis accuracy

Z Stage: GTS30V - 30mm travel; 0.05µm resolution; 2µm On-axis accuracy

Controller: XPS-C8 with XPS-DRV01 driver cards

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