

Application note 109: hollow shaft motor/encoder with inertia wheel

This note describes the actuator solution provided by Allied Motion for a capstan drive used in a high resolution (2600+ dpi) pre-press laser printer.

The initial capstan drive design by the customer used a third party discrete encoder with a separate inertia wheel and ‘pancake’ brush DC motor. This drive assembly displayed a torsional resonance in the coupling mechanism between the encoder and the rest of the assembly due to the overall length of the shaft and the position of the feedback encoder. The encoder was placed in a less than optimal position at the physical end of the drive, with the inertia wheel (the load) between the driving element (motor) and the feedback device (encoder), causing ‘windup’ of the shaft and therefore resonance at frequencies within the range of the feedback loop.

This torsional resonance was “mapped out” to a degree by means of a notch filter in the control loop and by means of mechanically damping the coupling. The resulting loss in performance and sharpness of the image, however, was hampering sales of the printer.

When asked to assist in a redesign, COPI integrated the motor, an inertia wheel and the high-resolution sine/cosine encoder feedback into a single, compact unit. The total hollow shaft length was kept as short as possible with the encoder in the ‘perfect’ position: between the driving element and the load. The extreme stiffness of the hollow shaft caused the torsional resonance frequency to be far beyond the response of the control loop (+12kHz) and thus was eliminated as a source of instability.

The redesign was directly responsible for increased performance and the printer was produced for close to a decade in large quantities. COPI was further invited to be involved in the design of various actuating mechanisms and main drive applications for the succeeding generations of drum and direct-to-plate printers.

For information and assistance, please contact:

COPI (800) 340 0404 technical assistance,
sales@opticalencoder.com
EMOTEQ (800) 221 7572 technical assistance,
sales@emoteq.com

