A LINEAR-ROTARY ELECTROMAGNETIC ACTUATOR

Field of Invention

The present invention relates broadly to linear-rotary electromagnetic actuators, and more particularly to linear-rotary electromagnetic actuators suitable for use with feedback control.

Background

Several approaches in the past to provide an actuator capable of both linear and rotary motion have encountered challenges. For example, in high-speed high-precision applications such as pick-and-place, die-bonding, etc, accuracy in the positioning control of the actuating mechanism is critical. For this reason, electromagnetic driving schemes preferably with some feedback control are favoured over pneumatic or hydraulic systems. One electromagnetic approach therefore provides a single rotor with differently oriented magnets arranged in a checkerboard configuration to produce a first magnetic field for linear motion and a second magnetic field for rotary motion. The resulting rotor is unfortunately both difficult and expensive to manufacture. Furthermore, in applications where the range of linear and/or rotary movement is relatively large, as the actuator moves linearly, it is likely to move out of range of the rotary feedback sensor or vice versa. One possible solution is to use multiple linear feedback sensors or multiple rotary feedback sensors, but this again can be expensive.

A need therefore exists to provide a linear-rotary electromagnetic actuator that can address the abovementioned problems.

Summary

In accordance with a first aspect, there is provided a linear-rotary electromagnetic actuator comprising a rotation module having an output shaft and a rotary encoder configured to sense rotary motion of the output shaft; and a translation module having an intermediate translator coupled to the rotation module such that a translational movement of the intermediate translator is provided to a moving coil relative to a fixed magnet of the rotation module or to a moving magnet relative to a fixed coil of the rotation module and a linear encoder configured to sense translational motion of the intermediate translator.

The rotary encoder may be fixed relative to the intermediate translator.