

Claims

What is claimed is:

1. A modular motor drive for use in fitness equipment, the modular motor drive comprising:

a switching circuit comprising a plurality of switches, the switching circuit responsive to switching control signals by selectively reconfiguring the plurality of switches to control supply of electrical energy to a motor of an exercise device according to the switching control signals; and an interface coupleable with an application control board of the exercise device, wherein:

responsive to a first switching control signal, the switching circuit configures the plurality of switches to drive the motor of the exercise device, and

responsive to a second switching control signal corresponding to electric braking of the motor, the switching circuit configures the plurality of switches to stop driving the motor of the exercise device.

2. The modular motor drive of claim 1, wherein the motor is an alternating current (AC) motor and at least one of the switching circuit or a braking control circuit of the modular motor drive is configured to apply direct current (DC) to a stator winding of the motor responsive to the second switching control signal, thereby braking the motor by DC injection braking.

3. The modular motor drive of claim 1, wherein at least one of the switching circuit or a braking control circuit is configured to reverse a field of a stator winding of the motor responsive to the second switching control signal, thereby braking the motor by plug braking.

4. The modular motor drive of claim 3, wherein the motor is an AC motor and reversing the field of the stator winding includes reversing a rotation of the field of the stator winding.

5. The modular motor drive of claim 1, wherein at least one of the switching circuit or a braking circuit is configured to route power generated by the motor responsive to the second switching control signal, thereby braking the motor by regenerative braking.

6. The modular motor drive of claim 5 further comprising a second interface for operably interconnecting the at least one of the switching circuit and the braking circuit to a power system of the exercise device to provide power from the motor to the power system during regenerative braking.

7. The modular motor drive of claim 1 further comprising a motor drive controller communicatively coupled to the switching circuit, the interface further for communicatively coupling the motor drive controller to an application controller of the application control board.

8. The modular motor drive of claim 7, wherein the switching circuit is configured to receive switching control signals including the first switching control signal and the second switching control signal from the motor drive controller.

9. The modular motor drive of claim 1, wherein the interface is further for communicatively coupling the switching circuit to an application controller of the application control board.

10. The modular motor drive of claim 9, wherein the switching circuit is configured to receive the first switching control signal and the second switching control signal from the application controller.

11. The modular motor drive of claim 1, wherein the second switching control signal is generated responsive to a user event associated with a user of the exercise device.

12. The modular motor drive of claim 11, wherein a user event is detectable based on at least one of meeting a threshold deviation from a force profile, detecting a loss of signal from a sensor, detecting a force reading indicative of a user imbalance, detecting a sensor signal indicative of user disengagement, or receiving a signal from an algorithm identifying possible user safety issues by monitoring at least one of system, environmental, or state information.

13. The modular motor drive of claim 1, wherein at least one of the switching circuit and a braking circuit is configured to short phases of the motor responsive to receiving the second switching control signal.

14. The modular motor drive of claim 13, wherein the at least one of the switching circuit and the braking circuit is configured to default into a state in which the motor phases are shorted.

15. An exercise device comprising:
a motor assembly comprising a motor;
an application board comprising an application board controller; and
a motor drive operably coupled to each of the motor and the application board, the motor drive comprising a switching circuit comprising a plurality of switches, the switching circuit responsive to switching control signals by selectively reconfiguring the plurality of switches to control supply of electrical energy to the motor according to the switching control signals,

wherein

responsive to a first switching control signal, the switching circuit configures the plurality of switches to drive the motor, and

responsive to a second switching control signal corresponding to electric braking of the motor, the switching circuit configures the plurality of switches to stop driving the motor.

16. The exercise device of claim 15, wherein the switching circuit is configured to receive the first control signal and the second control signal from the application board controller.

17. The exercise device of claim 15, wherein the motor drive further comprises a motor drive controller operably coupled to the application board controller and the switching circuit is configured to receive the first control signal and the second control signal from the motor drive controller.

18. The exercise device of claim 15, wherein the electric brake is one of a DC injection brake, a plug brake, or a regenerative brake.

19. A method of controlling motors in fitness equipment, the method comprising:

at a switching circuit of a motor drive coupled to a motor of an exercise device, the switching circuit comprising a plurality of switches and responsive to switching control signals by selectively reconfiguring the plurality of switches to control supply of electrical energy to the motor according to the switching control signals, receiving a switching control signal; and

responsive to receiving the control signal during driving of the motor, activating the switching circuit to stop driving the motor; and

applying an electric brake to the motor by at least one of DC injection braking, plug braking, or regenerative braking,

wherein:

the exercise device includes each of an application board including an application controller and a modular motor drive operably connected to the application board, the modular motor drive including the switching circuit and a motor drive controller operably connected to the application controller, the switching control signal received by the switch circuit from the motor drive controller.

20. The method of claim 19, wherein the modular motor drive is a first modular motor drive and the switching circuit is a first switching circuit, the method further comprising:

subsequent to replacement of the first modular motor drive with a second modular motor drive and at a switching circuit of the second modular motor drive, receiving a second control signal; and

responsive to receiving the second control signal, activating the switching circuit to at least one of drive the motor or electrically brake the motor.