wires **53**. As indicated by the arrows on second member **40** (**FIG. 9**), the relative movement between the second member and first member **38** may be linear, rotational or curvilinear. Thus, this embodiment of magnetically-controllable device **24** provides resistance forces to oppose linear, rotational or curvilinear relative movements between first member **38** and second member **40**.

[**0087**] The magnetically-controllable device **24** in **FIGS. 9 and 10** may be integrated into haptic interface unit **55** (**FIG. 3**), by mounting the device to frame **94** and having disc **96** act as second member **40** much the same as is shown in **FIG. 4***b*. In this case, disc **96** needs to comprise a magnetically soft material, as discussed above in reference to second member **40**. Similarly, a pair of devices, like the magnetically-controllable device **24** in **FIGS. 9 and 10**, may be integrated into haptic interface unit **155** (FIGS. **5**-**7***b*). This may be accomplished in a joystick, for example, by mounting the devices to housing **146** and having first and second translating plates **124** and **126** act as a second member **40** in each device. Of course, plates would need to be manufactured from a magnetically permeable material.

[**0088**] Finally, referring to **FIG. 11**, another embodiment of magnetically-controllable device **24** comprises first member **38**, having a curved, annular ring-shaped body, and second member **40** having a pivotable, disc-like body. Magnetic-field generating device **42** is an annular shaped member at the periphery of second member **40**, adjacent to first member **38**. Magnetically-controllable medium **34** is included in a chamber **35** and in the working space **36** between first member **38** and second member **40**. Magnetic-field generating device **42** creates a magnetic field through magnetically-controllable medium **34** in working space **36**, as represented by flux lines **44**, upon energization by controller **28** (not shown). Magnetic-field generating device **42** is connected to controller **28** by wires **53**.

[**0089**] An operator **22** (**FIG. 1D**) in operable contact with haptic interface device **26**, such as a joystick, moves second member **40** fixedly attached shaft haptic interface device **26**. Pivot member **172** opposes device **26** on the other side of second member **40**. Pivot member **172** preferably comprises a post having a ball-shaped end. Pivot member **172** is secured to magnetically-controllable device **24** by bottom plate **174**, which also is fixedly attached to first member **38**. Similarly, top member **176** may be connected to first member **38** to further reinforce magnetically-controllable device **24**. Thus, as one skilled in the art will recognize, the teachings of the present invention may be implemented in a variety of haptic interface units to provide resistance forces to oppose the motion of haptic interface device **26** in haptic interface system **20**. Moreover, it will be recognized that a wide variety of magnetically controllable devices may be utilized herein. For example, the magnetorheological fluid devices described in commonly assigned U.S. Pat. Nos. 5,816,372, 5,711,746, 5,652,704, 5,492,312, 5,284,330 and 5,277,281 may be used.

[**0090**] Although the invention has been described with reference to these preferred embodiments, other embodiments can achieve the same results. Variations and modifications of the present invention will be apparent to one skilled in the art and the following claims are intended to cover all such modifications and equivalents.

What is claimed is:

1. A haptic interface system comprising:

a haptic interface device movable by an operator in at least one direction of displacement, the haptic interface system providing resistance forces to the haptic interface device;

a controller for receiving a variable input signal and providing a variable output signal, said controller adapted for running a program that processes said variable input signal and in response derives said variable output signal; and

a magnetically-controllable device that receives said variable output signal and provides said variable resistance force in proportion to said variable output signal, said magnetically controllable device comprising a volume of a magnetically controllable medium, the variable resistance forces being provided by changing the rheology of the magnetically controllable medium in response to said output signal to thereby directly control the ease of movement of the haptic interface device, said variable resistance forces being provided to resist displacement of the haptic interface device by the operator in at least one direction of displacement of said device.

2. The haptic interface system as recited in claim 1, wherein said haptic interface device comprises a steering device.

3. The haptic interface system as recited in claim 2 wherein said steering device is for steering a vehicle or machine.

4. The haptic interface system as recited in claim 1, wherein said haptic interface device comprises a joystick.

5. The haptic interface system as recited in claim 2, wherein said haptic interface device comprises a steering wheel.

6. The haptic interface device as claimed in claim 2 wherein the steering device is a steering yoke.

7. The haptic interface system as claimed in claim 1 wherein said haptic interface device comprises a lever.

8. The haptic interface system as claimed in claim 1 wherein the magnetically controllable medium is magnetorheological powder.

10. The haptic interface system as recited in claim 1, wherein said magnetically-controllable device comprises:

a magnetic-field generating device energizable by said variable output signal to provide a variable strength magnetic field;

a first member adjacent to said magnetic field generating device;

a second member adjacent to said magnetic field generating device and connected to said haptic interface device; and

wherein said magnetically-controllable medium is located between said first member and said second member.

11. A haptic interface system as recited in claim 10, further comprising an absorbent element disposed between said first member and said second member, said absorbent element containing said magnetically-controllable medium.

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