62 and resistor 64 to ground. When sufficient current flows through resistor 64 to raise the base voltage of transistor 66, then this transistor conducts so that current flows through resistor 60, transistor 66 and resistor 68 to ground. This establishes feedback control which limits the current through the selected actuator wire 28, 28' etc. A light-emitting diode 70 is connected with switch 50 to provide a visual signal of the drive ON circuit. In each driver circuit 46 a light-emitting diode 72 is connected to also provide a visual signal to monitor the function of the circuit and verify its proper operation.

Control circuit 44 functions to control current through a selected SMA actuator wire 28 either at zero amperes when the voltage at resistor 60 is low, or at some value which is determined by the resistors 60, 68 and 64. The result is that the current in the selected actuator wire 28 is constant and does not depend upon the resistance of the individual actuator wires (which may vary) or on the resistances of the electrical contacts made to the SMA wires.

FIG. 6 illustrates an embodiment incorporating a tactile stimulator glove array 74 in accordance with the invention which is programmed and controlled by a computer system 76. In this embodiment the tactile elements and actuator means are incorporated into an instrumented glove 78 or other clinical diagnostic or virtual reality device. Control lines to and from the glove are combined in a cable 80 leading to a control circuit 82 which in turn is connected through a cable 84 with the host computer 76. A suitable power supply 86 is connected with the control circuit through cable. The computer is programmed to provide time-varying signals into control circuit 82 which in turn processes the signals and feeds them into the instrumented glove. The glove is worn on one hand of the patient, who senses the tactile feedback as the touch-stimulating portions of the tactile elements are moved by the shape-memory alloy actuators mounted within the glove.

The invention contemplates that the actuators in the different embodiments for the tactile elements may comprise shape-memory alloy materials in configurations other than wires. For example, the elements could be formed of shape-memory alloy films which move to and from their memory shapes when heated through the phase change transition temperatures. In addition, patterns of individual tactile elements can be held in fixed position (by steady-state control signals), or the elements could be rapidly changed (by transient control signals) to simulate the touch and feel of an object.

While the foregoing embodiments are at present considered to be preferred it is understood that numerous variations and modifications may be made therein by those skilled in the art, and it is intended to cover in the appended claims all such variations and modifications as fall within the true spirit and scope of the invention.

What is claimed is:

1. A tactile stimulator array system for providing tactile feedback to a person comprising the combination of at least one tactile element having a touch-stimulating portion, a reference structure, means for mounting the tactile element in a predetermined array relative to said reference structure for contact of said touch-stimulating portion by sense organs of the person, actuator means for moving the touch-stimulating portion between first and second positions, said actuator means including at least one actuator, said actuator being comprised of a shape-memory alloy material which changes between a first memory shape when heated through the phase change transition temperature of the material and a second shape when cooled below that temperature, and coupling means for operatively coupling said actuator with a respective tactile element for moving the touch-stimulating portion of the element between said first and second positions responsive to said change in shape of the actuator whereby movement of the touch-stimulating portion relative to the reference structure can be sensed by the person.

2. A tactile stimulator array system as in claim 1 in which said tactile element is comprised of a cantilever beam having a proximal end and a distal end, said proximal end being carried by the reference structure and said distal end comprising said touch-stimulating portion, said beam being formed of a flexible material having elastic memory so that the beam bends responsive to said change in shape of the actuator.

3. A tactile stimulator array system as in claim 2 in which said reference structure is comprised of a touch plate having at least one opening, said touch-stimulating portion of the tactile element being sized sufficient to permit such portion to move at least partially through the respective opening, and said actuator means moving a touch-stimulating portion of a selected tactile element to its second position where such touch-stimulating portion projects at least partially through the opening of the touch plate where it can be sensed by the person.

4. A tactile stimulator array system as in claim 1 further includes control means for heating selected actuators in a predetermined sequence for a predetermined time period sufficient to cause the shape-memory alloy material thereof to change to its memory shape.

5. A tactile stimulator array system as in claim 4 in which said control means includes control circuit means for directing pulses of electric current through the selected actuator.

6. A tactile stimulator array system as in claim 5 in which the control circuit means includes circuit means for generating pulse-width modulated current signal through the actuator for predetermined pulse time which is sufficient to prevent overheating of the actuator, while such actuator are in their memory shapes.

7. A method for providing tactile stimulation feedback for a person's sense organs, the method including the steps of mounting a tactile element means for movement between first and second positions relative to a reference structure, with the tactile element means in its second position being oriented relative to the reference structure for sensing by the person, coupling an actuator means of shape-memory alloy material to the tactile element means, said material being in a memory shape when heated through its phase change transition temperature and being in an other shape when cooled below that temperature, heating the actuator means through its phase change transition temperature to cause it to change to its memory shape for moving the tactile element means to its second position responsive to said change of shape of the actuator means to its memory shape, cooling the actuator means to below its phase change transition temperature to cause the actuator means to move to its other shape for moving the tactile element means to its first position while moving the actuator means to its other shape, and generating a control signal having successive pulses which are varied over time in a predetermined sequence for causing the actuator means to undergo successive cycles of heating and cooling responsive to the pulses to cause