712 employs porosity membranes. While each inlet valve **703** is controlled by control signal(s) transmitted by wire **713**, each outlet valve **704** is controlled by electrical signals transmitted over a wire **714**. Every inlet valve **703** or outlet valve **704** employs at least one porosity membrane **710**. Porosity membranes **710** are coupled (or faced) to a liquid reservoir wherein each membrane **710** is configured to control how much liquid should enter and/or pass through membrane **710**. An advantage of using porosity membranes is to maintain the deformation of insulated layer **706** with minimal or no energy consumption. As such, a grid of haptic cells using variable porosity membrane **710** may be used to control the surface texture of touch-sensitive surface of the interface device.

[0077] FIG. **8** is a side view of an interface device **800** having an array of haptic cells **802** using various resonant devices in accordance with one embodiment of the present invention. The array of haptic cells **802** can be used to implement tactile regions for controlling surface textures. Device **800** includes an insulated layer **806** and a haptic layer **812**. While the top surface of insulated layer **806** is configured to receive an input from a user, the bottom surface of insulated layer **806** is placed adjacent to the top surface of haptic layer **812**. The bottom surface of haptic layer **812** is, in one embodiment, placed adjacent to a display (not shown in FIG. **8**), wherein haptic layer **812** and insulated layer **806** may be substantially transparent thereby objects or images displayed in the display can be seen through haptic layer **812** and insulated layer **806**. It should be noted that insulated layer **806** may be flexible whereby it is capable of providing desirable relief information on its surface.

[0078] Haptic layer **812**, in one embodiment, includes a grid of haptic cells **802**, wherein each cell **802** further includes a permanent magnet **804**, an electro magnet **810**, and two springs **808**. Haptic layer **812** is similar to haptic layer **612** shown in FIG. **6**(*a*) except that haptic layer **812** employs resonant devices while haptic layer **612** uses MEMS pumps. Haptic cell **802**, in one embodiment, uses a resonant mechanical retractable device to generate haptic effects. The resonant mechanical retractable device vibrates in response to a unique frequency, which could be generated by a side mounted resonant stimulator **816** or a rear mounted resonant stimulator **814**. A resonant grid, in one embodiment, is used to form a haptic layer **812**. Each cell **802** is constructed using resonant mechanical elements such as Linear Resonant Actuator ("LRA") or MEMS springs. Each cell **802**, however, is configured to have a slightly different resonant frequency and a high Q (high amplification at resonance and a narrow resonant frequency band). As such, each cell **802** can be stimulated using mechanical pressure waves originating at the edges of the sheet. The haptic effects can also be generated by a piezoelectric or other high bandwidth actuator.

[0079] Cell **802**, in another embodiment, includes one spring **808**. In yet another embodiment, cell **802** includes more than two springs **808**. Each spring **808** is configured to respond to a specific range of frequencies thereby each spring **808** can produce a unique haptic sensation. As such, a grid of haptic cells using various resonant devices may be used to control the surface texture of touch-sensitive surface of the interface device. For example, if the displacement of haptic mechanism is sufficiently high such as 200 micrometers or greater, the movement (or tactile vibration) with low frequencies such as 50 Hz or less should sufficiently create desirable relief information.

[0080] The exemplary embodiment(s) of the present invention includes various processing steps which will be described below. The steps of the embodiments may be embodied in machine or computer executable instructions. The instructions can be used to cause a general purpose or special purpose system or controller, which is programmed with the instructions, to perform the steps of the embodiment (s) of the present invention.

[0081] FIG. **9** is a flowchart illustrating a process **900** for providing a haptic device and haptic texture using a deformable surface in accordance with one embodiment of the present invention. At block **902**, a process receives a first substrate activating signal. In one embodiment, the first substrate activating signal is used to identify a surface pattern associated with the first substrate. After block **902**, the process proceeds to the next block.

[0082] At block **904**, the process generates a first pattern of a haptic substrate via haptic feedback in response to the first substrate activating signal. In one embodiment, the process selects one of many surface patterns in accordance with the first substrate activating signal. Alternatively, the process activates multiple tactile regions of the haptic substrate independently to create a predefined pattern in response to the first substrate activating signal. After block **904**, the process proceeds to the next block.

[0083] At block **906**, the process activates a deforming generator to generate a force capable of changing the shape of the flexible surface layer. In one embodiment, the process activates a vacuum generator to create a vacuum between the flexible surface layer and the haptic substrate to cause the flexible surface layer to collapse against the first pattern of the haptic substrate. After block **906**, the process proceeds to the next block

[0084] At block **908**, the process reconfigures or changes the surface texture of the flexible surface layer from a first surface characterization to a second surface characterization in accordance with the first pattern. In one embodiment, the process pushes the flexible surface layer against the first pattern to confirm the flexible surface layer as the first pattern or the first topography. Upon sensing a contact on the flexible surface, the process, in one embodiment, generates an input signal in response to the contact and sends the input signal to a processing unit. The process is also capable of receiving a user input via a touch on the flexible surface and providing a tactile feedback to confirm the user input. It should be noted that reconfiguring surface texture of the flexible surface layer includes changing from a smooth surface to a coarse surface. In an alternative embodiment, the process is capable of generating a second pattern of a haptic substrate in response to a second activating signal and forcing a flexible surface layer to confirm the second pattern of the haptic substrate. Upon confirmation of the second pattern, the flexible surface changes its surface texture from the second surface characterization to a third surface characterization in response to the second pattern. After block **908**, the process ends.

[0085] While particular embodiments of the present invention have been shown and described, it will be obvious to those skilled in the art that, based upon the teachings herein, changes and modifications may be made without departing from this invention and its broader aspects. Therefore, the appended claims are intended to encompass within their scope of all such changes and modifications as are within the true spirit and scope of the exemplary embodiment(s) of the present invention.