

particular an API 49, that contains a value of vibration intensity as expressed as a percent. Use of the API 49 offers a tuning configuration for vibration elements and motors that serves as the basis for a duty-cycle calculation. Specifically, start and stop pulses may be calculated based on vibration motor specific tuning parameters and user vibration parameters. Furthermore, the vibration control signal is corrected based on battery voltage. Benefits of the above described exemplary and non-limiting embodiments of the invention include the production of vibration effects with better reliability, lower field failure rate (FFR), a broader range of implementation in applications, a better user experience, and easier product integration.

[0044] With reference to FIG. 7, there is illustrated a vibration control pulse 21 and the corresponding vibration response 71. As is evident, the resulting vibration response 71 exhibits sharp transitions resulting in a desirable tactile effect.

[0045] The embodiments of this invention may be implemented by computer software executable by a data processor of the mobile device 41, such as the data processor 43, or by hardware, or by a combination of software and hardware. Further in this regard it should be noted that the various blocks of the logic flow diagram of FIG. 5 may represent program steps, or interconnected logic circuits, blocks and functions, or a combination of program steps and logic circuits, blocks and functions.

[0046] The memory 45 may be of any type suitable to the local technical environment and may be implemented using any suitable data storage technology, such as semiconductor-based memory devices, magnetic memory devices and systems, optical memory devices and systems, fixed memory and removable memory. The data processor 43 may be of any type suitable to the local technical environment, and may include one or more of general purpose computers, special purpose computers, microprocessors, digital signal processors (DSPs) and processors based on a multi-core processor architecture, as non-limiting examples.

[0047] In general, the various embodiments may be implemented in hardware or special purpose circuits, software, logic or any combination thereof. For example, some aspects may be implemented in hardware, while other aspects may be implemented in firmware or software which may be executed by a controller, microprocessor or other computing device, although the invention is not limited thereto. While various aspects of the invention may be illustrated and described as block diagrams, flow charts, or using some other pictorial representation, it is well understood that these blocks, apparatus, systems, techniques or methods described herein may be implemented in, as non-limiting examples, hardware, software, firmware, special purpose circuits or logic, general purpose hardware or controller or other computing devices, or some combination thereof.

[0048] Embodiments of the inventions may be practiced in various components such as integrated circuit modules. The design of integrated circuits is by and large a highly automated process. Complex and powerful software tools are available for converting a logic level design into a semiconductor circuit design ready to be etched and formed on a semiconductor substrate.

[0049] Programs, such as those provided by Synopsys, Inc. of Mountain View, Calif. and Cadence Design, of San Jose, Calif. automatically route conductors and locate components on a semiconductor chip using well established rules of design as well as libraries of pre-stored design modules. Once

the design for a semiconductor circuit has been completed, the resultant design, in a standardized electronic format (e.g., Opus, GDSII, or the like) may be transmitted to a semiconductor fabrication facility or "fab" for fabrication.

[0050] The foregoing description has provided, by way of exemplary and non-limiting examples, a full and informative description for carrying out the invention. However, various modifications and adaptations may become apparent to those skilled in the relevant art in view of the foregoing description, when read in conjunction with the accompanying drawings and the appended claims.

[0051] Furthermore, some of the features of the preferred embodiments described above could be used without the corresponding use of other features. As such, the foregoing description should be considered as merely illustrative of the invention, and not limiting the invention.

What is claimed is:

1. A method comprising:
 - defining a plurality of parameters for a vibration control pulse comprising a start pulse and a stop pulse; and
 - outputting said vibration control pulse to a vibration element to provide tactile feedback.
2. The method of claim 1 wherein said vibration element forms a part of a touch screen.
3. The method of claim 1 wherein said vibration element forms a part of a battery powered mobile device.
4. The method of claim 1 wherein said start pulse comprises a positive voltage and said stop pulse comprises a negative voltage.
5. The method of claim 1 wherein said plurality of parameters comprises at least one of an intensity parameter, a vibration nominal voltage, a vibration nominal start pulse, and a vibration nominal stop pulse.
6. The method of claim 1 wherein said plurality of parameters are defined in an application program interface.
7. The method of claim 1 wherein said vibration element comprises a haptic actuator.
8. A method comprising:
 - defining a first plurality of parameters for a first vibration control pulse;
 - outputting said first vibration control pulse to a vibration element to provide tactile feedback;
 - defining a second plurality of parameters for a second vibration control pulse having a polarity opposite that of said first vibration control pulse; and
 - outputting said second vibration control pulse to said vibration element to provide tactile feedback.
9. The method of claim 8 wherein said vibration element forms a part of a touch screen.
10. The method of claim 8 wherein said vibration element forms a part of a mobile phone.
11. The method of claim 8 wherein said first and said second plurality of parameters comprises at least one of an intensity parameter, a vibration nominal voltage, a vibration nominal start pulse, and a vibration nominal stop pulse.
12. The method of claim 8 wherein said first and said second plurality of parameters are defined in an application program interface.
13. The method of claim 8 wherein said vibration element comprises a haptic actuator.