one or more of the electrodes to receiving circuitry **115** before demodulation. In practice, each electrode may be connected in any manner to allow signals to be applied on one subset of electrodes **112** and received on another subset.

[**0044**] In various embodiments, two or more electrodes which serve to receive channels (e.g. analogous to channel **113** described above) may be provided with independent resultant signals **116**. Further, inactive or unused electrodes (e.g. **112**E&G may be coupled to an electrical reference (e.g. ground) or driven with a modulated signal to improve spatial resolution on the active receive channels. This reference is commonly referenced as a shield or guard signal, which may be applied via multiplexing logic **502** or the like.

[**0045**] Digital coding and other spread-spectrum techniques may be equivalently applied in sensors that operate in any number of different manners. FIG. **6**A, for example, shows an exemplary sensor **600** that includes any number of modulated electrodes **112**A-B arranged in any single or multi-dimensional fashion that are coupled to a capacitive filter (e.g. an integrating capacitor **610**) which linearly transforms the charge transferred by the modulated electrodes. A microcontroller **102/104** or the like suitably generates distinct digital codes **106** that modulate **112**A-B coupled to **114** electrode as described above. In this case, however, the digital codes **106** are not necessarily intended to encode the voltage provided to each electrode **112**A-B, but rather to control the timing of charge that is transferred to **114**. By controlling the timing of each electrode's charging and discharging and then observing the amount of charge collected at integrating capacitor **610** from **114**, the amount of charge provided by each electrode **112**A-B can be determined from the demodulated signal **118**. The charging of each electrode **112**A-B can be controlled by selecting digital codes **106** such that voltage is applied to each electrode only when charge should be transferred to the receiving electrode **114**, and otherwise allowing it to float. By selectively providing charge from individual and/or groups of electrodes **112**A-B to capacitor **610**, the amount of coupling from each electrode **112**A-B (which is affected by the proximity of an object **121**) can be determined.

[**0046**] FIG. **6**B presents an alternate embodiment of an exemplary sensor that has unified sensing and driving on each electrode **112** that is filtered or demodulated by one or more capacitors **610**. The codes **106** modulate drive circuitry **109**, which may be implemented as a current source connected to the electrodes **112**. The response of the electrode to the drive circuitry is affected by the coupling of an object **121** near the electrode, and the resultant signals (e.g. the voltage resulting from the coupling) are filtered and/or demodulated by the circuit **604** and capacitor **610**. The filtered signals may be further demodulated to determine position attributes of the object. Further, more than one electrode could be simultaneously driven with substantially orthogonal codes and after demodulation a stable coupling of one electrode **112**A to another electrode **112**B would substantially cancel out. These and many other position sensing methods benefit from digital coding and spread spectrum techniques.

[**0047**] With reference now to FIG. **7**, various sensors **700** formed in accordance with the coding techniques described herein may be formed on a single circuit board or other substrate **702**. In such embodiments, electrodes **112**A-G forming sensing region **101** may be disposed on one side of the substrate, with the processing components (e.g. controller **102** and the like) formed on the opposite side. Because various sensors (e.g. sensors **100** and **500** shown in FIGS. **1** and **5**) do not require physical movement of sensing and receiving electrodes **112**, **114** with respect to each other, electrodes **112**, **114** in such sensors may be rigidly fixed on substrate **702** in any manner. Substrate **702** can be made of a flexible material to allow for folding or bending. Further, a protective surface **704** may be deposited or otherwise placed over the electrodes to provide consistent dielectric isolation and to protect against moisture, dust and other environmental effects. Surface **704** may also provide tactile feedback to the user as appropriate. FIG. **8** shows an exemplary sensor **800** is formed on a flexible substrate **802** as appropriate. FIG. **8** also shows that the various processing components may be found on the same side of substrate **802** as the modulated and sensing electrodes , and that the substrate **802** may also provide tactile feedback for region **101**. It should be appreciated that the various concepts, structures, components and techniques described herein may be inter-combined and/or modified as appropriate to create a wide variety of alternate embodiments.

[**0048**] Accordingly, there are provided numerous systems, devices and processes for detecting a position-based attribute of a finger, stylus or other object in a position sensing device such as a touchpad. While at least one exemplary embodiment has been presented in the foregoing detailed description, it should be appreciated that a vast number of variations exist. The various steps of the techniques described herein, for example, may be practiced in any temporal order, and are not limited to the order presented and/or claimed herein. It should also be appreciated that the exemplary embodiments described herein are only examples, and are not intended to limit the scope, applicability, or configuration of the invention in any way. Various changes can therefore be made in the function and arrangement of elements without departing from the scope of the invention as set forth in the appended claims and the legal equivalents thereof.

What is claimed is:

1. A method of detecting a position-based attribute of an object with respect to a touch-sensitive region comprising a plurality of electrodes, the method comprising the steps of:

producing a plurality of distinct digital codes used to create a plurality of modulation signals applied to an associated at least one of the plurality of electrodes to obtain a resultant signal that is electrically affected by the position of the object;

demodulating the resultant signal using the plurality of distinct digital codes to thereby discriminate electrical effects produced by the object; and

determining the position-based attribute of the object with respect to the plurality of electrodes from the electrical effects.

2. The method of claim 1 wherein the determining step comprises identifying at least one peak value of the electrical effects.

3. The method of claim 1 wherein the determining step comprises computing a centroid of the electrical effects.