$$V04 = V01 - V02 \quad \text{(Expression 10)}$$
$$= -(Cs/Cf)\cdot(R2/R1)\cdot(Vin/A)$$

[0061] Accordingly, the voltage **V04** of the detection signal output from the output terminal **24** of this electrostatic capacitance detection circuit **30** is in proportion to the capacitance value Cs. Therefore, unknown capacitance value Cs and a fluctuation in the capacitance can be easily specified by executing various signal processing based on this voltage **V04**.

[0062] As clarified from comparison between this expression 10 and the expression 5 that indicates the voltage Vout of the detection signal according to the first embodiment, unlike the first embodiment 30, the detection signal obtained by the electrostatic capacitance detection circuit **30** according to the second embodiment contains only a component being in proportion to the capacitance of the capacitor **17**, and does not contain any unnecessary offset (i.e. the voltage that does not depend on the capacitor **17**). Therefore, signal processing according to the second embodiment, which specifies capacitance or a fluctuation in the capacitance of the capacitor **17** from the detection signal, can be simple.

[0063] Although a case of **V03=−V01** is used in this example, the present invention is not limited to this. According to a type of the capacitive sensor, the output voltage **V04** can be set as follows with a case of **V03**=k·**V01** (k is an amplification ratio of an inverting amplification unit).

$$V04=\{k\cdot(Cs/Cf)+(k+1)\}\cdot(R2/R1)\cdot Vin$$

[0064] **FIG. 5** is a diagram showing a practical example to use the electrostatic capacitance detection circuit according to the first and second embodiments for an electric device. Here, it shows a cross section diagram of a microphone **50** used for a mobile phone or the like which comprises a capacitor microphone and an electrostatic capacitance detection circuit that are integrated into one. This microphone **50** comprises a lid cover **51** having a sound hole **52**, an oscillating film **53** that oscillates with sounds, a ring **54** that fixes the oscillating film **53**, a spacer **55***a*, a fixed electrode **56** set up against the oscillating film **53** via the spacer **55***a*, an isolation board **55***b* that supports the fixed electrode **56**, an IC chip **58** forming the electrostatic capacitance detection circuit according to the above embodiment, which is fixed on a backside of the isolation board **55***b*, an IC package **59** that molds the IC chip **58**, external electrodes **61***a* and **61***b* that are connected by the IC chip **58**, a wire bonding or the like.

[0065] The oscillating film **53**, which is one side of the electrodes that forms the capacitor, is connected to specific potential (a ground in this example), and the fixed electrode **56**, which is the other side of the electrodes, is connected to a circuit of the IC chip **58** via an electric conductor such as an aluminum board, a wire bonding, or a contact hole. Capacitance and a change in the capacitance of the capacitor comprising the oscillating film **53** and the fixed electrode **56** are detected by the electrostatic capacitance detection circuit in the IC chip **58** located adjacently via the isolation board **55***b*, transformed into an electric signal, and output from the external electrodes **61***a* and **61***b*, or the like. The lid cover **51**, which is made from a metal such as aluminum, serves as a role of a shield box that shields any disturbance noise mixed into the inner capacitors **53** and **56**, and the IC chip **58** with a conductive film (not shown) formed on an upper surface of the isolation board **60**. In this example, the fixed electrode **56** is connected to the circuit, and the oscillating film **53** is connected to specific potential. However, the oscillating film **53** may be connected to the circuit, and the fixed electrode **56** may be connected to the specific potential. But, the former case is preferable from past experiences.

[0066] **FIG. 6** is an external view diagram showing an outline of the microphone **50** shown in **FIG. 5**. **FIG. 6 A** is a plain view, **FIG. 6 B** is a front view, and **FIG. 6 C** is a bottom view diagram. Size of the lid cover **51** shown in **FIG. 6 A** and **FIG. 6 B** is, for example, approximately ϕ5 mm in diameter ×2 mm in height. Four external electrodes **61***a*~**61***d* shown in **FIG. 6 C** are, for example, two terminals for a power supply and two terminals for an output signal of the electrostatic capacitance detection circuit.

[0067] In such a practical example, the capacitor to be detected (the capacitor microphone in the example here) and the electrostatic capacitance detection circuit (the IC chip in the example here) are located adjacently, the signal line is extremely short, and the stray capacitance thereof is connected by an electric conductor of which length does not exceed ten times as much as a bigger capacitance value of either the capacitor microphone or the first impedance element in the circuit. Then, these parts are covered with a shield material such as a metal lid cover. Therefore, in the practical example like this, any negative impacts such as disturbance noise, which is mixed into the signal line(the electric conductor)connecting the capacitor to be detected and the electrostatic capacitance detection circuit, can be ignored.

[0068] That is, in a compact microphone like this, since the capacitor to be detected and the electrostatic capacitance detection circuit are connected each other by an extremely short electric conductor, connecting them by a shield cable and using a special circuit for applying guard voltage to the shield make the size of the circuit rather bigger and impede miniaturization of the circuit. Therefore, it is preferable that the capacitor to be detected and the electrostatic capacitance detection circuit are connected by a non-shielded (unshielded) conductive board, wiring pattern, wire bonding, lead line or the like through a shortest route. As other example of the microphone, **FIG. 7** and **FIG. 8** show the circuit put on a board. It is basically the same as the example according to the above embodiment with the exception of the electrostatic capacitance detection circuit put on a board **62**.

[0069] Although the electrostatic capacitance detection circuit according to the present invention has been described based on the two embodiments and the practical examples applied to a product, the present invention is not limited to these embodiments and practical examples.

[0070] For instance, in the electrostatic capacitance detection circuits **10** and **30**, the capacitor **15** is connected between the operational amplifier **14** and the impedance converter **16** to detect electric current flowing through the capacitor **17**, but an impedance element such as a resistance or an inductance may be connected.

[0071] Also, as shown in **FIG. 9**, it is possible to connect a resistance **18** in parallel with the capacitor **15** in the