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Excursion Sensing On The Surround Of An Acoustic Transducer

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EXCURSION SENSING ON THE SURROUND OF AN ACOUSTIC TRANSDUCER

ABSTRACT

A device to monitor vibration excursion of speakers is disclosed. The device primarily uses a vibration sensor attached to the speaker suspension (surround). The sensor is overmolded onto the spider of the speaker. Both the sensor transducer and the acoustic transducer can use the –ve terminal as ground while voltage output of the sensor is monitored from the sensor +ve terminal. The surround moves together with the voice coil, which may or may not be attached to a former. The vibration sensor can be made of a PVDF coated thin piezo sensor or can be made of a flex sensor. The strain induced when the sensor is deflected will generate a voltage (in the case of the PVDF coated piezo) or a change in resistance for the flex sensor. These are monitored by a control circuit that computes the excursion from either of these parameters.

BACKGROUND

Excursion sensing is becoming more and more useful for acoustic transducers. This is especially relevant when designing and implementing micro-speakers. Micro-speakers are being integrated into enclosures that restrict the overall excursion of the moving mass (membrane) in height. The main problem is low frequency performance of these transducers, which usually lack bass. To compensate for this deficiency, the transducer is driven with higher voltages below resonance. This creates a problem since the maximum sound pressure level is limited by how much excursion space there is in the enclosure. For traditional loudspeakers, excursion sensing may not be relevant in most cases but when there is a wave-guide or a grill over the transducer, it may become important to have some sort of excursion sensing/monitoring application. Excursion sensing can become very relevant as well for sound quality since large loudspeakers have parameters (BL(x), Kms(x) and Le(x)) used in calculating distortion levels that are a direct

function of the excursion. Monitoring the excursion can be used to keep the distortion of the loudspeaker below a certain threshold by applying an appropriate adaptive filter.

DESCRIPTION

A device to monitor vibration excursion of speakers is disclosed. The device primarily uses a vibration sensor attached to the speaker suspension (surround), as illustrated in FIG. 1. The highlighted lime green is the sensor overmolded onto the spider. Both the sensor transducer and the acoustic transducer can use the −ve terminal as ground while voltage output of the sensor is monitored from the sensor +ve terminal. The surround moves together with the voice coil, which may or may not be attached to a former. The vibration sensor can be made of a PVDF coated thin piezo sensor (as not to add extra stiffness) or can be made of a flex sensor. The strain induced when the sensor is deflected will generate a voltage (in the case of the PVDF coated piezo) or a change in resistance for the flex sensor. These are monitored by a control circuit that computes the excursion from either of these parameters.

A PVDF piezo sensor is often used for flex touch vibration and shock measurements. A small AC and large voltage (up to +/- 90V) is created when the film moves back and forth, which could be detected using appropriate circuitry. As a flex sensor is flexed, the resistance across the sensor increases, which is sensed appropriately.

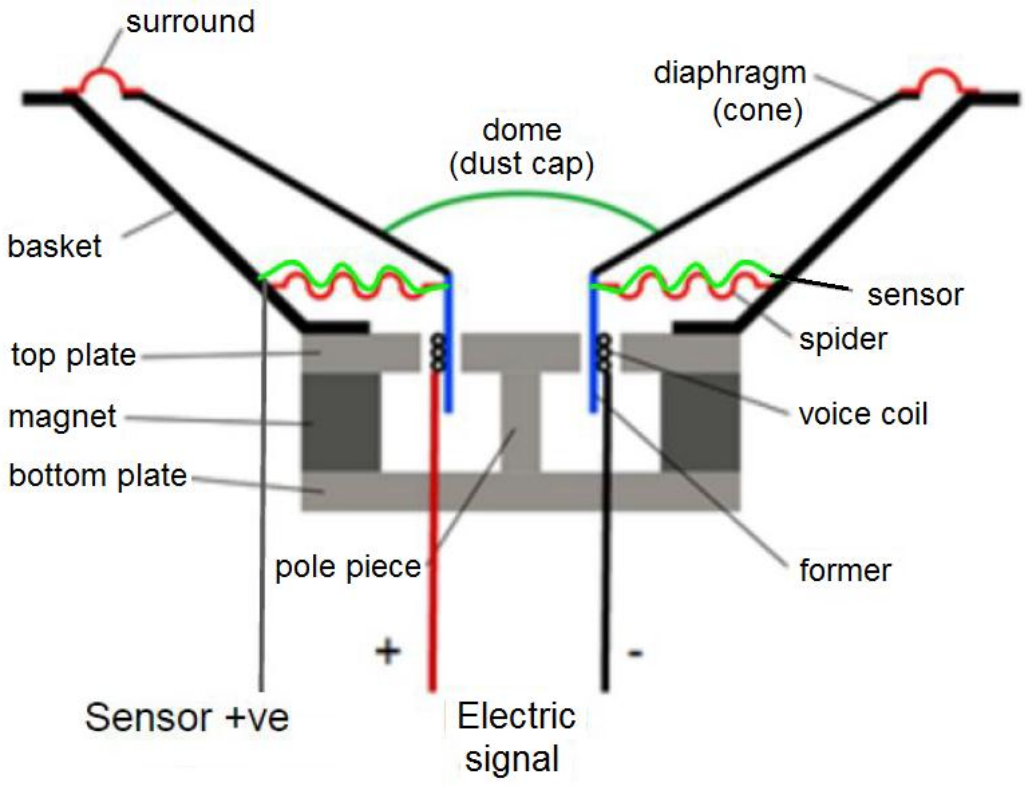

FIG. 1: Device for excursion sensing on the surround of an acoustic transducer

The disclosed device provides monitoring of vibration excursion while requiring minimal calibration, which would otherwise be difficult to measure.