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# USING OF TRANSDUCER FOR PRESSURE DISTRIBUTION MEASUREMENT IN BIOMEDICINE

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This paper deals with tactile carpet based on conductive rubber of Japanese origin. Briefing of take and prove results and experiences with this rubber are introduced. This transducer is determined for pressure distribution measurement on human sole. Authors analyse other problems, too: dimensions of carpet for static measurement, for monitoring of human locomotion and other technology aspects.

## 1. Measurement Device

Measurement of pressure distribution between the sole and the defined pad is very important. This problem occurs in biomechanics, orthopaedics, prospectively for further branches in medicine. The measurement of pressure distribution is non-invasive method for classification of some internal diseases, too [1].

In the recent past several methods were used for pressure distribution measurement, as photosensitive layer, photoelastic sheets, linquit crystals or optical fibres [2], but none of them can be applicable for normal condition range.

Measuring devices using conductive rubber [4], [5] showing better qualities, indicate not only simple contact but they can give quantitative information because they can represent face in matrix of taking sensor elements. These elements made of conductive rubber [3] for transducer matrix enable the size of pressure in several levels.

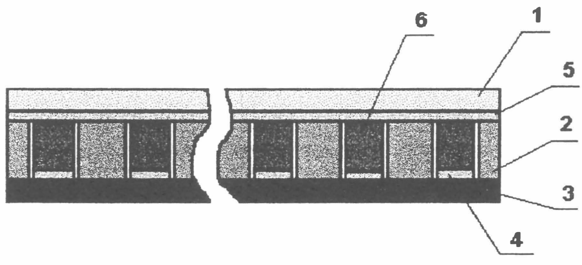


Fig. 1 The construction of PMT 1.4

The transducer PMT1.4 was tested for this purpose. Design the transducer PMT1.4 shows Fig.1. The conductive elastic material 6 lies between couple of the electrodes 4 and 5. One of these electrodes 4 is placed on the basic plate 3 and the second one 5 on the elastic cover layer 1. This layer transfers axial pressure force to the conductive material 6. The distance insert 2 serves for an adjustable working range of the sensor and for the protection of the conductive material against overloading, too. The transducer is without mobile mechanical elements.

The dependence of resistance from axial pressure force R=f(F) presents Fig.2. The relation between the load on the transducer and the deformation of sensing elements is not linear in all range. The electrical signal is not linear either. The electrical output signal can be linearized very easy by one resistor or by computer.

Sensitive area of transducer has dimension 300x400mm and one sensor element 3x3mm with 1mm space between two sensors. The total number of sensors is 7500 (matrix area 100x75 sensors). Nominal pressure range is 0 - 40 kPa and max. range (overload) 0 - 200 kPa. For recording of dynamic load by runnig sampling of the whole transducer is supposed 250 times in one sec. (1.875 MHz).

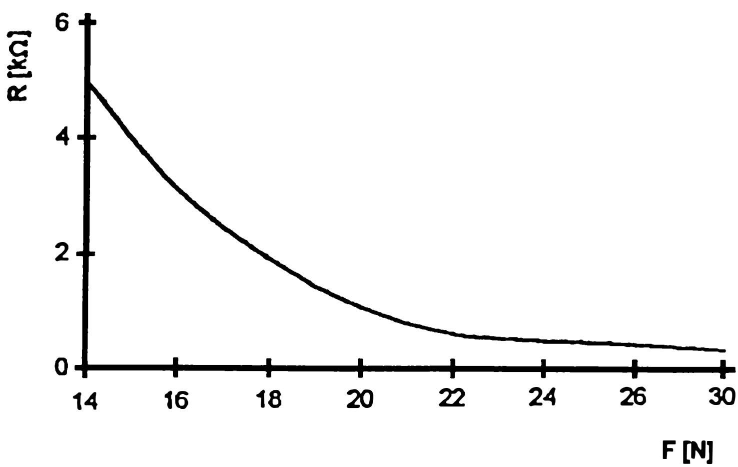


Fig. 2 The dependence R = f(F)

## 2. Results

Properties of conductive rubber was well tested for right function of the transducer. Therefore all parameters were tested, e.g., long-time stability is about 2 % (Fig. 3), influence of temperature, repeatability output signal by loading etc. Bearing by dynamic loading shows Fig. 4. Noise is 0.6 % of the active signal by loading. Some dynamic parameters of transducer were mentioned in [4]. The results of these all measurements will be presented in full version of paper. Practical application and tests have proved full applicability for biomechanical purpose by human locomotion.

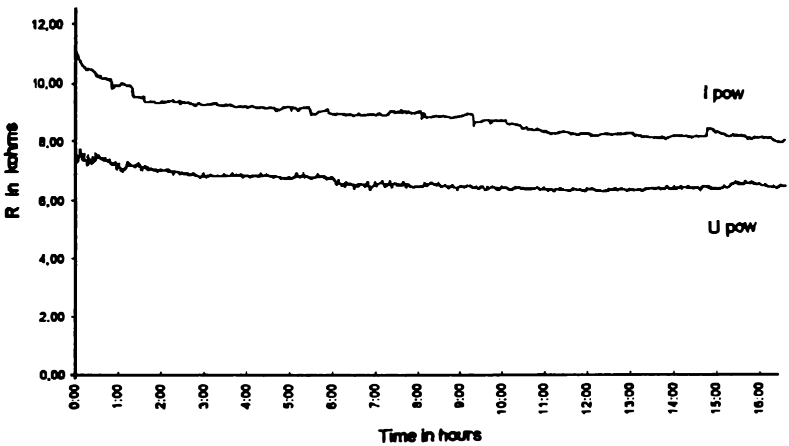


Fig. 3 Test of Stability R(t)

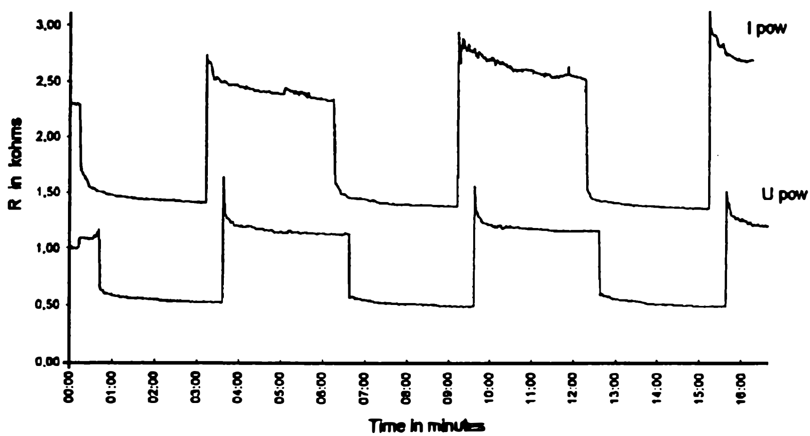


Fig. 4 Test of Transducer Resistivity Changes

**Rerefences**


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