DEVELOPMENT OF TECHNOLOGY ULTRASONIC THICK MEASURING AT DYNAMIC MODE

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Abstract: Researches of accuracy thicknessmeasurements of products were carried out with an automatic registration of results ultrasonic thickmeasuring. For various spatial positions of controllable area depending on parameters of scanning and a kind of a contact liquid optimum directions and speeds of scanning were established and criteria of maintenance of acoustic contact are formulated.

Introduction: Traditionally ultrasonic thick measuring products (pipes, cases etc.) are carried out in a static mode by installation probe in the given position on a surface of a product and fixation of indications thick measuring device. Ultrasonic thick measuring device the SKAT - 4000 allows carrying out scanning of product's surface with simultaneous automatic results registration. There is an opportunity to register a relief of a product in the field of scanning. However there is a question on allowable speeds of scanning and accuracy of measurements in a dynamic mode. The last is especially important. At the dynamic mode local changes of quality in the acoustic contact, arising at movement probe on a controllable surface, may create additional errors.

Results: Researches of this question were carried out using measuring device the SKAT - 4000 with the encoder equipped with piezoelectric converter P112-5-∅10/2-01. Ultrasonic thick measuring device allows to measure thickness with step about 0,1 mm and automatically registrate the results of thick measuring with 2 mm step. On each step thick measuring device measure minimal thickness, which can be displayed on PC or printed.

thick measuring was carried out:

- with various speed (20 mm/c, 30 mm/c, 40 mm/c, 60 mm/c, 100 mm/c);
- in various spatial positions of area of the control (horizontal, lateral, movement upwards, movement downwards, under the sample);
- with various contact liquids (glycerin and glue).

Experiments were carried out on beforehand-prepared surface with the put greasing so that to exclude influence of ganging surface quality on the results of measurements. For maximum deviation of results thick measuring from real thickness of a product was accepted measurements errors of the device - 0.1 mm.

At processing results thick measuring calculation of amount and lengths of sites with loss of acoustic contact for various speeds and directions of scanning was carried out, and also presence of dependence between accuracy of thickness measurements in a dynamic mode and the amount of acoustic contact losses was determined during scanning.

Conclusions: In conditions of experiments realization and with the used equipment it is established:

1. With increase of scanning speed in all spatial positions the error of measurements grows (fig.1).
2. The best thick measuring results was received at scanning in horizontal and lateral positions.

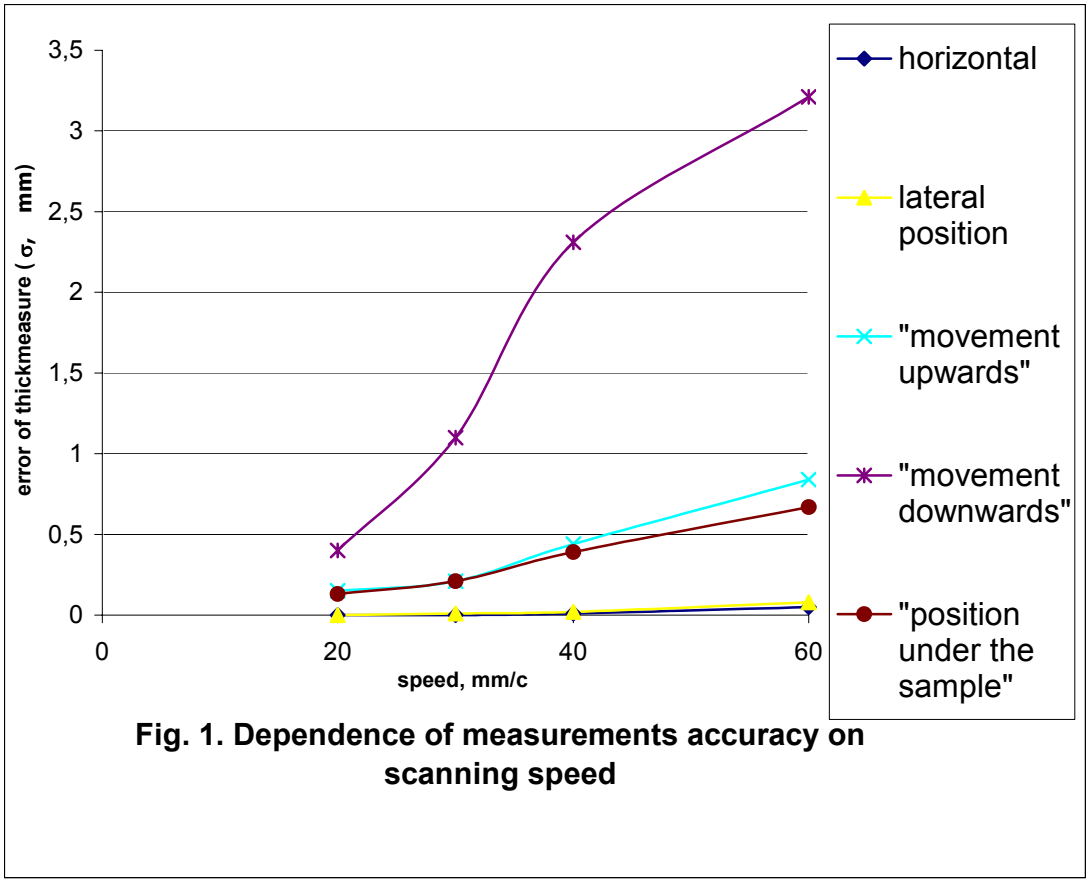

Fig. 1. Dependence of measurements accuracy on scanning speed

3. Optimum speed of scanning at various positions of scanning areas was:

-horizontal position (fig.2,4,5,6) - no more than 60 mm/c; accuracy of the thickness measure was no more than 0,05 mm with probability of 95 %, amount of losses acoustic contact - no more than 1,4 % of scanned lengths.

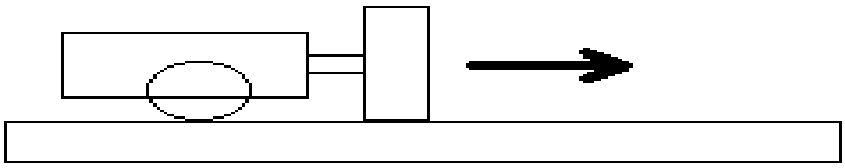

Fig.2 Horizontal position

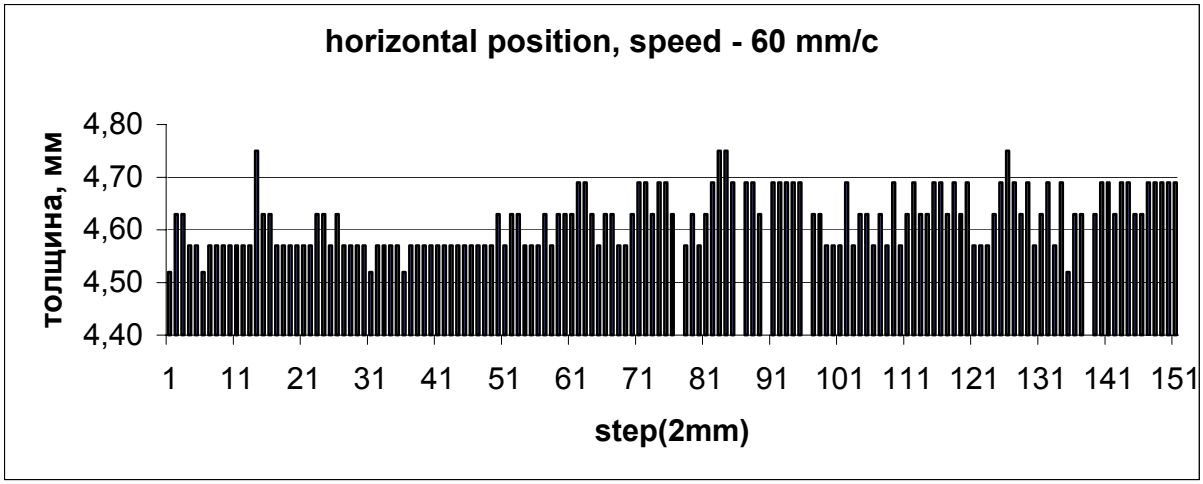

Fig.3 Scanning results

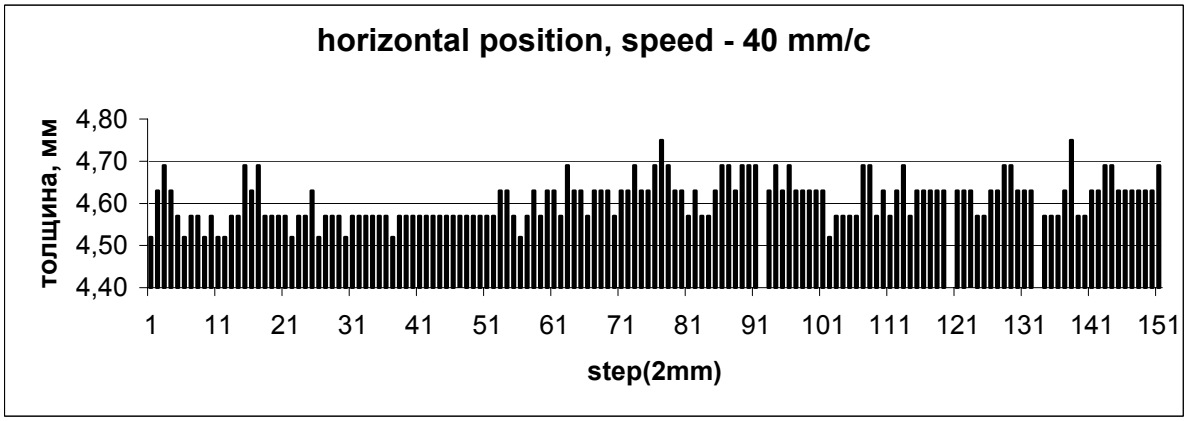

Fig.4 Scanning results

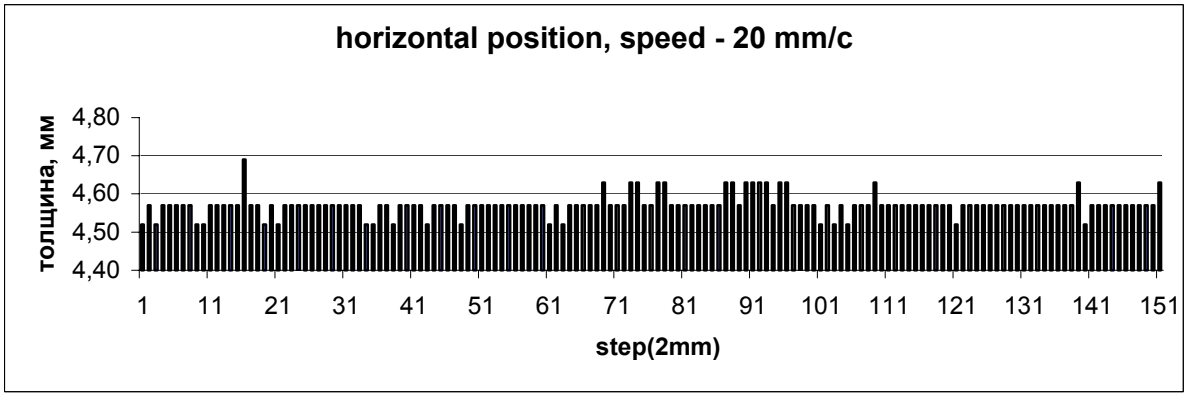

Fig.5 Scanning results

-lateral position - no more than 60 mm/c; accuracy of the thickness measure was no more than 0,08 mm with probability of 95 %, amount of losses acoustic contact - no more than 2,1 % of scanned lengths.

- movement upwards - no more than 20 mm/c; accuracy of the thickness measure war no more than 0,15 mm with probability of 95 %, amount of losses acoustic contact - no more than 2,9 % of scanned lengths.
- position under the sample - no more than 20 mm/c; accuracy of the thickness measure was no more than 0,13 mm with probability of 95 %, amount of losses acoustic contact - no more than 2,5 % of scanned lengths.

4. At movement in a direction "downwards" measurements are inexpedient because of inadmissible amount of acoustic contact losses and small accuracy of the control. So as a result of confluence of a contact liquid and formation of a liquid wedge in the data received by automatic thick measuring more than 10 % of scanned lengths occupy by losses of acoustic contact, and accuracy does not exceed 0,4 mm.

5. Using glycerin as a contact liquid in 3,5 times in comparison with glue reduces amount of acoustic contact loses.

6. Scanning limit speed in all positions 100 mm/c, because device at higher speed does not fix all points of the way. So at scanning in horizontal position amount of the fixed points (indication occurs through 2 mm) was from 124 up to 144 instead of 150.

7. Dependence between amount of acoustic contact losses and speed scanning is monotonous.

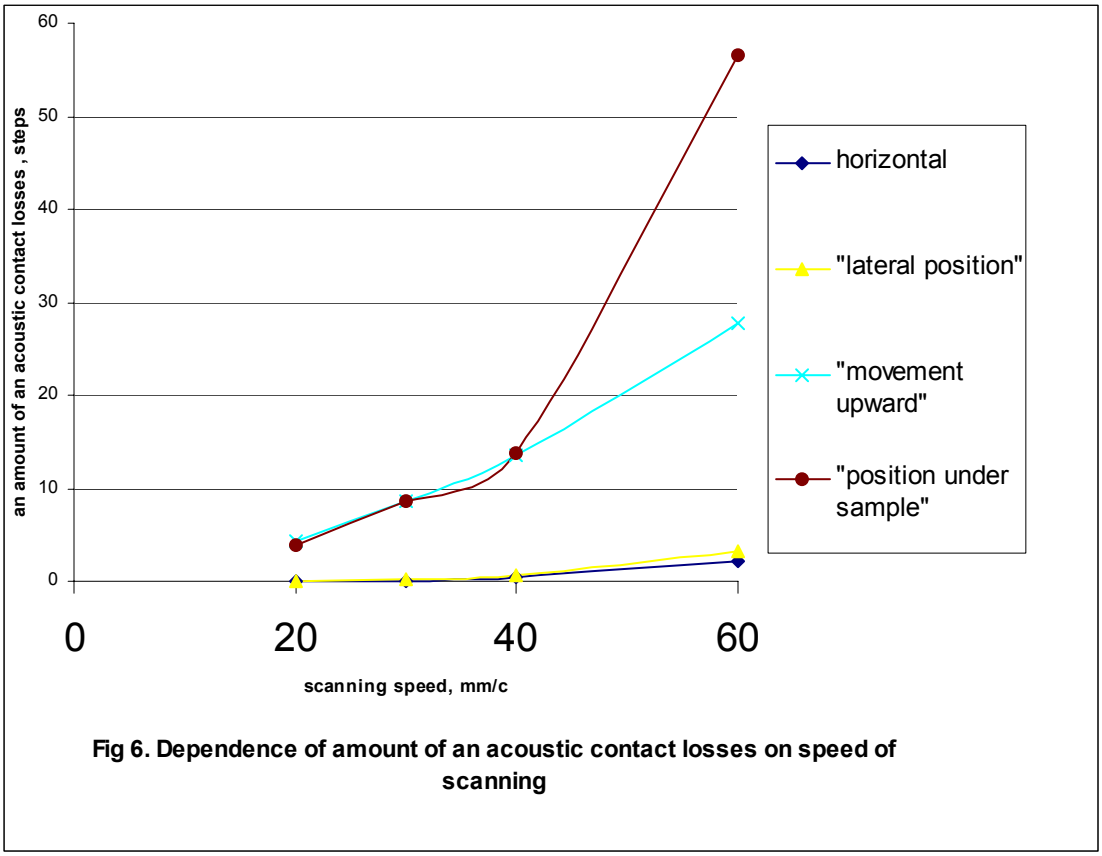

Fig 6. Dependence of amount of an acoustic contact losses on speed of scanning

8. Dependence between amount of acoustic contact losses and accuracy of thick measuring is monotonous.

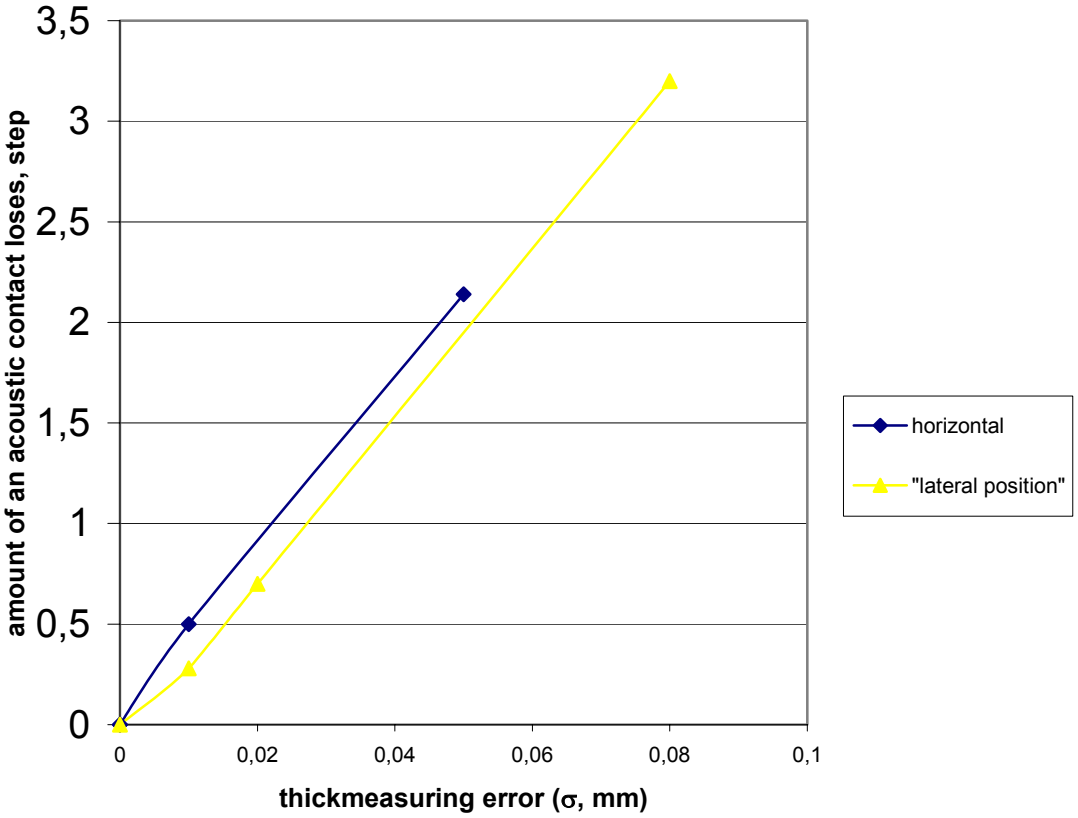

Fig.7Dependence of amount of an acoustic contact losses on accuracy thickmeasuring