The transducer protection device

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The transducer protection device is an original mechanical device, designed to protect measuring heads of scanning devices against getting damaged due to a collision with an examined object (a massive material sample, a structural element, etc.). The device has been constructed in the Department of Anisotropic Structures at the home Institute and its prototype is shown in Fig. 1. At present, the transducer protection device has been undergoing the patent protection procedure [1].

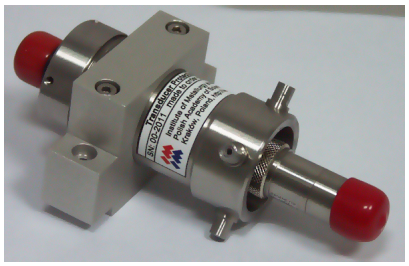

Figure 1. Transducer protection device (prototype) ready to exploitation (for the purpose of device testing at the KSI company laboratory, it was named ***Transducer Protection Device***)

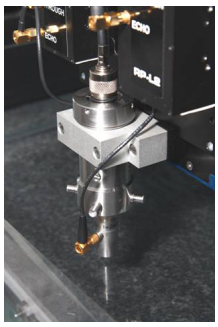

Figure 2. The prototype of the transducer protection device mounted on the EVO II acoustic microscope (manufactured by KSI) to protect the scanning head

The operation of the transducer protection device was verified in practice with great success, which proved the device to protect efficiently the transducer of the EVO II acoustic microscope used in the research laboratory at the Institute (Fig. 2). The efficiency of the transducer protection device was also confirmed during sophisticated operational tests, directly at the manufacturer's of acoustic microscopes (Kraemer Sonic Industry, Germany).

The operation of the transducer protection device is based on taking advantage of the energy of collision of material objects to trigger a mechanism that removes one of the objects participating in the collision (the ultrasound transducer in this case) to a safe distance, thus preventing the object from getting destroyed. This action is performed automatically and does not require additional power supply or external control. It is triggered at the moment a protected object (e.g. a measuring head) comes into contact with an obstacle. The direction of protected element removal is always the same and it coincides with the direction of the longitudinal axis of the transducer protection device. In case the above-mentioned ultrasound transducer of the acoustic microscope is protected, the removal distance is about 10mm and it suffices to protect the head against getting damaged due to a collision with a massive object (sample). The transducer protection device with a mounted scanning head and a fastening grip (Fig. 1) weighs about 0.5kg.

All device elements are made of corrosion-proof materials (18-9 grade steel), which makes it fit to operate in humid environment.

The presented transducer protection device is equipped with controls to adjust the parameters of its operation (removal distance, reaction sensitivity, range of transmitted loads). When

mounted on a movable structural element, the device withstands the load factor of up to 3g. It is very easy to restore the operating status after a collision. It requires a several seconds long adjusting operation to be performed by the operator, without any need to disassemble the head. Moreover, it is not needed to perform additional adjustment of the settings, as the original position (before the collision) of the scanning head is restored with the precision reaching 10μm in each available direction of head movement.

The presented transducer protection device is most similar - in terms of its functionality - to advanced (which means: expensive, requiring power supply and more advanced instrumentation) anti-collision systems used in automotive industry, aeronautics and transport.

The device can also be implemented in other types of scanning microscopes. Although the presented design solution is not characterised by universality of its applications, upon appropriate modification according to the specific character of a particular application, it can also be used for other types of scanners, e.g. varnishing or printing scanners, etc. The transducer protection device finds a potential domain of its application in structures/devices, where specified elements should be particularly protected against getting damaged due to a collision with other objects. The term "particularly protected"

refers to these parts that should not get damaged during a collision, because of their significance/cost. In each particular application of the transducer protection device, it is required to be adjusted according to pre-defined conditions of its operation.

Bibliography

Jan Bonarski i Krzysztof Gajda: Patent application # BPP/4331/2012.