Radio Engineering and Electronics

DEVELOPMENT OF MODULATION TRANSFER FUNCTION TEST BENCH FOR IMAGE INTENSIFIER TUBES

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Image Intensifier Tube (IIT) remains a critical device. However, most of the IIT inspection techniques in Russia are quite old and rely on human judgment. Modulation Transfer Function (MTF) of IIT is still measured according to GOST 21815.18-90. This standard describes MTF estimation using a set of line patterns and manual focusing. Thus, focus quality depends on human vision and MTF is measured at fixed spacial frequencies. We report on the system which is being designed to produce automated MTF measurement of IIT using the slanted edge method. This method provides receiving continuous MTF.

The functional chart of the developed MTF test bench prototype is shown in figure 1. The slanted edge image, formed by the GOST 21815.0-86 traceable light source and the edge target, is relayed to IIT input by the optical system. This optical system consists of a collimating lens and a projecting lens. An IIT is placed in the specialized container which has all the connections for IIT power supply. The camera mated with optics collects the curved IIT output image which is used for MTF processing. The projecting lens and the camera with its optics are installed on the Zolix TSA50-C [2] motorized linear stages which are connected to Zolix SC300 motion controller. The controller is connected to a PC via RS-232 interface. The positioning system described above will help to implement autofocus routine.

To obtain MTF from the slanted-edge image received from the IIT output the edge scan function (ESF) is computed first. It is computed by

summarizing pixel intensity values in every column along the edge. To prevent emerging camera matrix noise on the spectrum, ESF approximation is used. Investigation of a most efficient approximation technique for MTF processing is being carried out. To compute the line spread function (LSF) the first derivative of the approximated ESF is taken. Then fast Fourier transform of the LSF is used to obtain continuous MTF [1] (figure 2).

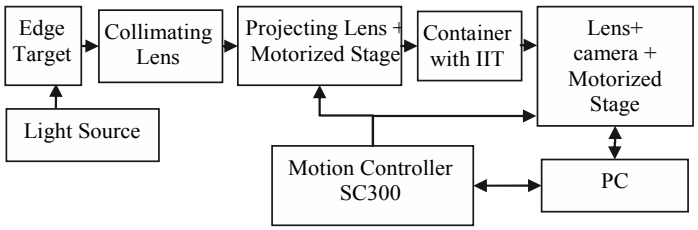

Fig. 1. MTF test bench functional chart

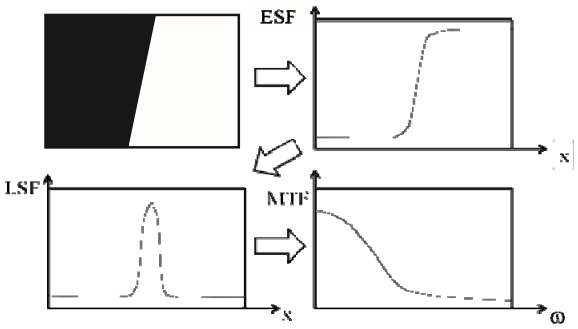

Fig. 2. Slanted edge method illustration

Currently software of the system is being designed. Interface of the system, programs for motorized stages control and image capture have already been created. Image processing and autofocus routine programs need further refinement.

References

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OPTIMIZATION OF THE PARAMETERS OF THE SYNCHRONOUS MOTOR FOR A SPECIAL HIGH-SPEED ELECTRIC DRIVE.

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The research of a synchronous motor with permanent magnets on the rotor and the anchor winding made by MAXON technology is described.

A high-speed electric drive based on a slotless engine with permanent magnets has a number of advantages and new positive properties compared to conventional drives. As well as in other types of electric machines the use of permanent magnets in magnetic systems of synchronous machines is caused by the desire to reduce the dimensions and weight of the machine, simplify the design, increase the efficiency and improve the reliability.

The main task is development and production of a high speed electric drive designed for metal film application (an alloy of gold, copper and silver) on the superconducting ceramics. To provide high level of adhesion, it is proposed to apply coating by means of "micro-explosion", when the particles of metal dust are accelerated at the moment of contact with ceramics to speed approximately 3.5 times higher than the speed of sound. Acceleration of particles is carried out in a pipe with tapered holes on the edges which rotates about an axis passing through the middle of the "atomizer" with a frequency of 34000 rpm.

A synchronous machine with permanent magnets on the rotor and the armature winding made with MAXON technology were used. The packet of stator has no teeth, and the coils of the armature windings are moved out in the air gap. For the first time the idea of creation such type of motor was advanced by Professor V. M. Kazansky in the mid 70's. Nowadays the