Television Image Filtering in Ship Model Analysis. Reduction of Noise Factors

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Abstract – **A method for image filtering in ship motion analysis is described. The method uses image imposing for error recognition and elimination.**

Keywords – **image filtering, motion analysis, ship model analysis.**

I. Introduction

Exploring of moving systems as well as their parameters requires development of systems for remote measuring. Part of these systems uses different types of visual methods for determining of the necessary parameters. One of the most important and fundamental parameters are the coordinates and the position of the explored moving body. A method for determining them is tracing of the explored object with the appropriate tracing system including two cameras on one side, and on the other side three dot light sources mounted on the object. In developing of methods for determining of coordinates of moving solid bodies based on tracing camera systems, an additional image processing is needed. A number of limitations and requirements are set in order to achieve best results. The greatest parts of the errors in these methods are a consequence of wrong segmented dot light sources. In this relation the following decision for minimizing the errors of this type is proposed

II. Essence of the Method

The goal of this research work is exploring of the behavior of ship models. It is necessary to know their six degrees of freedom and to determine their motion parameters. The explored ship model is observed by two cameras. It has three dot light sources which are actually traced by the both cameras. The two sequences of images are used to determine the exact position and behavior of the moving solid body.

The method proposed here consists of realization of image imposing and error elimination. The dot light sources mounted on the ship model , are chosen flickering dot light sources with the appropriate frequency, so that the following could be achieved: guaranteed time of lightning and guaranteed time of dark, so that in two contiguous frames to have both light and dark. The devices are synchronized so that it is possible to have all the odd frames with light up sources and all the even frames with dark. The speed of the explored ship models is such that guarantees unnoticeable differences in two contiguous frames.

This fact allows the imposing of the images from two contiguous frames for ignoring the errors.

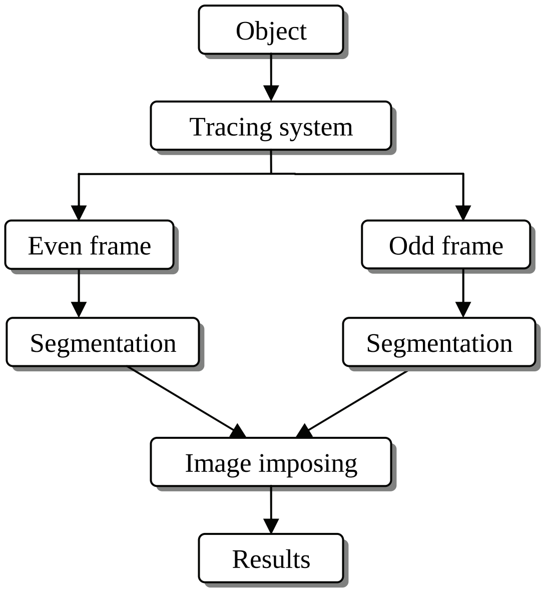

Fig. 1. Block scheme

The goal is with the imposing to be determined the identical segments and to remove them from the image. In this way it would be achieved the determining of the exact position of the dot light sources on the raster, as they are the only provoked difference between the frames. In this way is ignored the possibility to have accidental light sources (natural or artificial) as well as reflections of light sources and objects.

III. Technical Requirements

For right choice of the technical appliances it is necessary to know the exact parameters of the image. Serious question is how to determine the time period of light and dark, and how to control them. The basic here is the image forming. The interlaced image forming has the following parameters:

Field frequency:

$$F_K = 50Hz \tag{1}$$

Period of the frames:

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$$T_K = \frac{1}{F_K} = 20ms \quad (2)$$

In the interlaced forming the image always consists of lines (z). So for the frequency of the lines could be written the following:

$$F_x = F_Y.z = 50.312{,}5 = 15625Hz \quad (3)$$

The period of the lines has:

$$T_x = \frac{1}{F_x} = 62\mu s \quad (4)$$

These are the basics for the image forming.

For the dot light sources is chosen a frequency equal to the frequency of the frames, so that it could be guaranteed light or dark through all of the duration of the frame. For synchronization it is used the vertical blanking pulse of the frame. By its falling edge is controlled the flickering of the light source mounted on the ship model.

IV. RESULTS

Here is an example of results on the different stages of applying the method.

1. First step that is applied is the division of the even frames from odd ones. They differ from each other by the lightning of dot light sources mounted on the ship model.

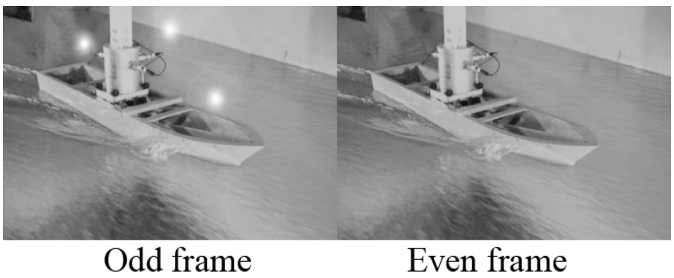

Fig. 2. Images taken from the cameras

2. Second stage is the segmentation of both even and odd frames. By the segmentation is defined a threshold under which all the pixels of the image go black and over the threshold all the pixels go white. In this stage the brightest segments are differentiated from the rest of the image.

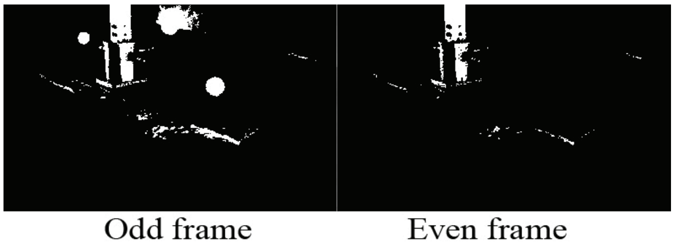

Fig. 3. Segmented images

3. Final stage of image processing is the image imposing. Both segmented images are used in this final stage. The resultative image.

Fig. 4. Result after imposing

In this view starts the calculation of the real coordinates of the explored solid body. These calculations make the real trajectory of the object of the exploration.

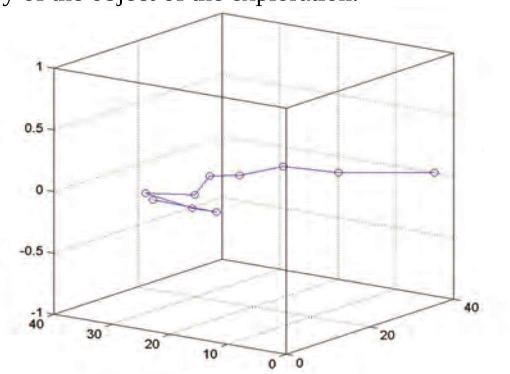

Fig. 5. 3D trajectory

V. CONCLUSION

A method for image filtering and error minimizing is proposed. By this method, large percent of the erroneous data is ignored and the object behavior is better explored. The data taken has a minimum of errors and the trajectory created by the images is the closest to the real one.

REFERENCES

[1] I.P.Petrishki, “Television basics”, TU-Varna, Varna,1994
[2] William K. Pratt, "Digital image processing", John Wiley and sons, USA, 2001.