Prototype of the Optical Triangulation Scanner for Shape Measurement of the Drill-pipe Joint

Rinat Diyazitdinov
Networks and communication systems department
Povolzhskiy State University of Telecommunications and Informatics
Samara, Russia
rinat.diyazitdinov@gmail.com

Introduction

The shape measurement of the drill-pipe joint is a specific task. This field for a long time has been shadowed because it is very specific. The special mechanic devices have measured the joint shape by caliber. The caliber helps to check the seizing of the joint. There are two problems of the mechanic devices:

- high cost (replacement or buy is a nontrivial task);
- immobility (is no possibility to use such devices in the environmental test, outside the shop floor of the enterprise).

So the problem of the development of a universal device for measurement joints that is independent of their shape became very important.

Measurement by the optical triangulation scanner

The solution for the shape estimation of the drill-pipe joint by the optical triangulation scanner does not develop at the current time.

The scanners [1] allow measuring the object shape with relatively big size (from a few centimeters to one meter). The object shape should be convex. The convex shape reflects laser to the image matrix. It allows for avoiding re-refraction. The joint of the drill pipe has the joint step 5 .. 10 mm and the shape is not convex.

It leads that overexposure interference distorts the contour of the joint. The measured data cannot be used for the quality estimation of joint profiles.

The prototype of the optical triangulation scanner was developed for this task.

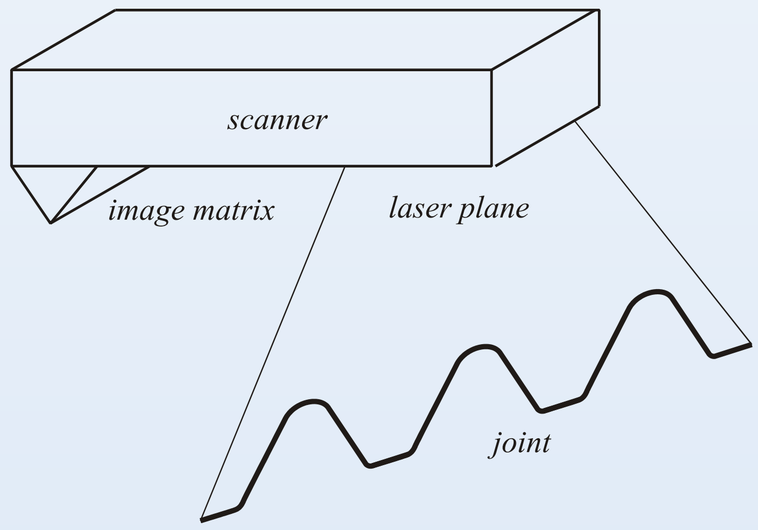

Fig 1. Triangulation scanner

Results

The result of the research is a prototype of the optical triangulation scanner. Fig. 2 shows the joint and laser line of a scanner.

Fig. 3 and 4 show the superposition reference contour with measured contour by a camera with a standard objective lens and varifocal objective lens.

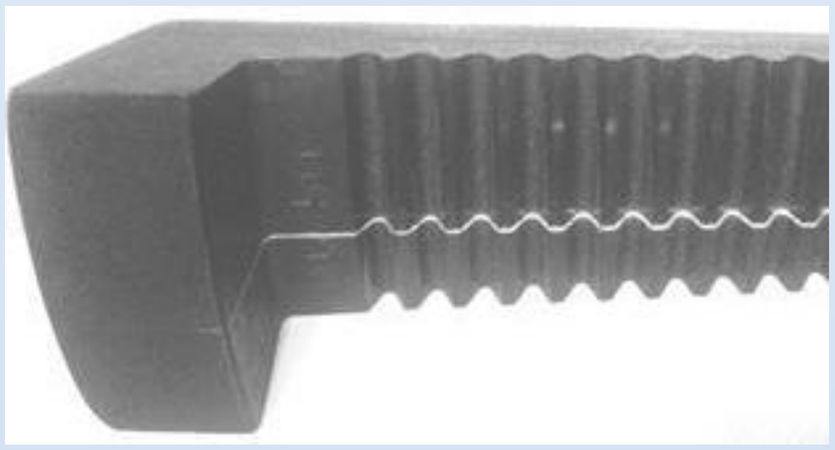

Fig 2. Joint of drill-pipe

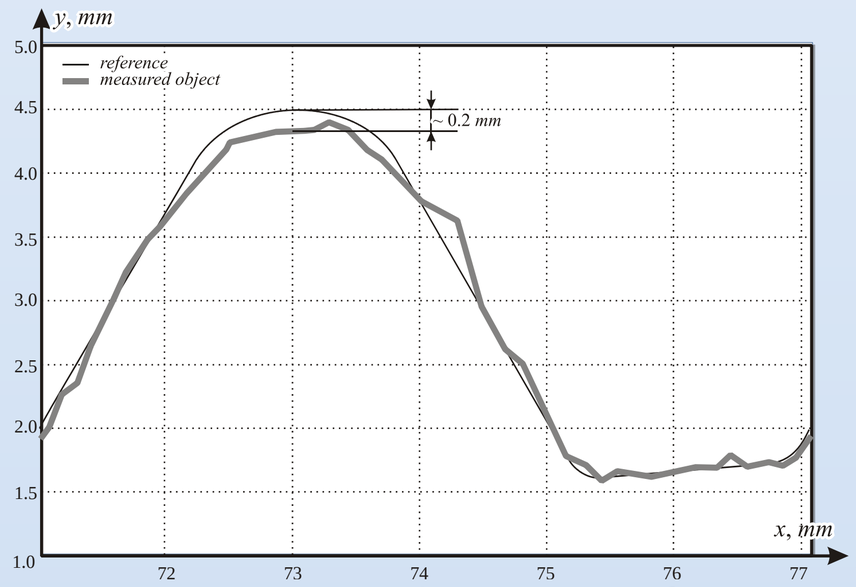

Fig 3. Measured contour of joint by camera with standard objective lens

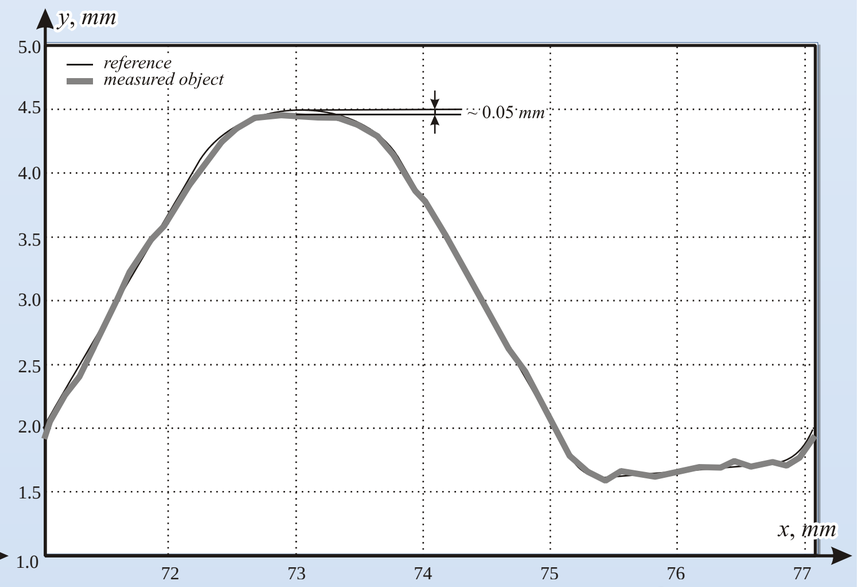

Fig 4. Measured contour of joint by camera with varifocal objective lens

Conclusion

The superposition of the measured profile with the reference profile has demonstrated that the error of measuring is about 0.05 mm. Such measurement accuracy allows estimation of the quality of the joint profile. The prototype can use for the development of the automatic inspection shape geometry systems for the drill-pipe joint.

References

[1] R.R. Diyazitdinov, "Matching of drill-pipe thread with reference profile," Infocommunication Technologies, vol. 14, no. 1, pp. 59-64, 2016, 10.18469/ikt.2016.14.1.09.

[2] N.N. Vasin, and R.R. Diyazitdinov, "Processing of triangulation scanner data for measurements of rail profiles," Computer Optics, vol. 42, no. 6, pp. 1054-1061, 2018, 10.18287/2412-6179-2018-42-6-1054-1061.

[3] E.V. Myasnikov, "Estimation of parameters geometric transformation for superposition portrait images," Computer Optics, vol. 31, no. 3, pp. 77-82, 2007.

Povolzhskiy State University of Telecommunications and Informatics
Samara, Russia
https://www.psuti.ru/