PROCEEDINGS

53. IWK

Internationales Wissenschaftliches Kolloquium
International Scientific Colloquium

Faculty of
Mechanical Engineering

PROSPECTS IN MECHANICAL ENGINEERING

8 - 12 September 2008

www.tu-ilmenau.de

TECHNISCHE UNIVERSITÄT
ILMENAU

Home / Index:
http://www.db-thueringen.de/servlets/DocumentServlet?id=17534

Published by
Impressum

Publisher Herausgeber	Der Rektor der Technischen Universität Ilmenau Univ.-Prof. Dr. rer. nat. habil. Dr. h. c. Prof. h. c. Peter Scharff
Editor Redaktion	Referat Marketing und Studentische Angelegenheiten Andrea Schneider Fakultät für Maschinenbau Univ.-Prof. Dr.-Ing. habil. Peter Kurz, Univ.-Prof. Dr.-Ing. habil. Rainer Grünwald, Univ.-Prof. Dr.-Ing. habil. Prof. h. c. Dr. h. c. mult. Gerd Jäger, Dr.-Ing Beate Schlütter, Dipl.-Ing. Silke Stauche
Editorial Deadline Redaktionsschluss	17. August 2008
Publishing House Verlag	Verlag ISLE, Betriebsstätte des ISLE e.V. Werner-von-Siemens-Str. 16, 98693 Ilmenau

CD-ROM-Version:

Implementation Realisierung	Technische Universität Ilmenau Christian Weigel, Helge Drumm
Production Herstellung	CDA Datenträger Albrechts GmbH, 98529 Suhl/Albrechts

ISBN: 978-3-938843-40-6 (CD-ROM-Version)

Online-Version:

Implementation Realisierung	Universitätsbibliothek Ilmenau ilmedia Postfach 10 05 65 98684 Ilmenau

Home / Index:
http://www.db-thueringen.de/servlets/DocumentServlet?id=17534

53rd Internationales Wissenschaftliches Kolloquium
Technische Universität Ilmenau
08 – 12 September 2008

A. Nagy/ P. Horváth

Development of an angular displacement sensor

INTELLIGENT MECHANICS IN ROBOTICS

Sometimes we need to measure the angle of rotation without contact in order to avoid disturbance of the examined object. It is the case for example when investigating the dynamic behavior of stepping motors. This paper presents a very simple and low cost optical way to measure the angle of rotation with sufficient accuracy [1]. The method [2] developed at Széchenyi István University is based on the light reflection, which depends on the known surface quality. The output of the applied CNY 70 reflective optical sensor placed at constant distance from the moving surface changes if the diffusion property of the reflecting surface varies (Figure 1).

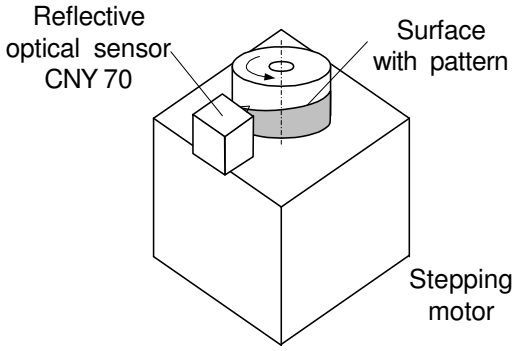

Figure 1

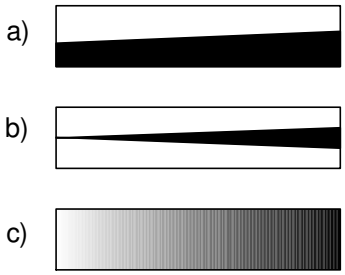

Figure 2

Three different patterns has been investigated: (a) black and white half plane with slanting transition, (b) black arrow on a white surface, (c) continuous transition from pale gray to black. Patterns were printed to paper stripes and glued to a cylindrical disc attached to the axis of the stepping motor (Figure 2). During the calibration procedure the stepping motor was driven by moderate step frequency of 10 Hz, while output voltage was measured by a digital oscilloscope (Figure 3, output voltage vs. angular displacement). During tests the distance between the sensor and disc was kept constant: 1, 2 and 3 mm. The role of the sensor position was also investigated, parallel

and perpendicular to the axis of symmetry.

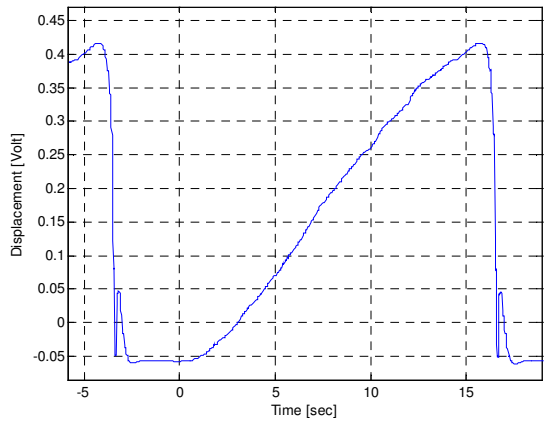

Figure 3

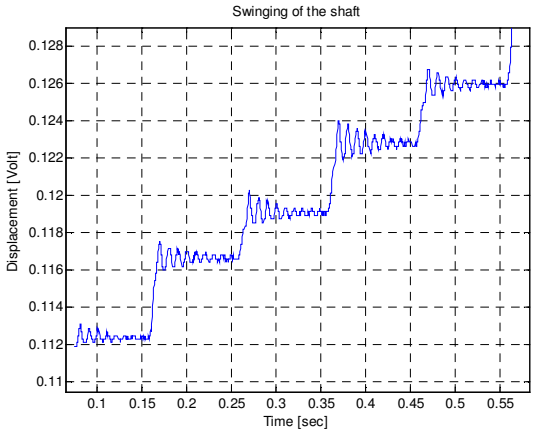

Figure 4

Conclusions

- The best results were gained by pattern „c" because it was the less sensitive to position errors of sticking.
- Distance between the sensor and reflecting surface have also effect onto the results. The best result was gained at a distance of about 3 mm.
- Sensor position (parallel/perpendicular) has no considerable effect.

Without further signal processing only a limited accuracy can be reached, but the results are acceptable for qualitative investigation of the dynamics of a stepping motor of 1.8° step angle (Figure 4). As the static curve exhibits strictly monotonous features, the output signal can be linearized applying the inverse characteristics.

References:
[1] Chartier, G: Introduction to optics. Springer, New York. 2005.
[2] Horvath, P: Analysis of a low cost angular sensor, Engineering Mechanics, Vol.12, No A1, 2005. p. 107-112

Authors:
Attila Nagy, PhD student
Dr Péter Horváth
Széchenyi University, Egyetem sqr. 1.
H-9026 Győr, Hungary
Phone: 00 36 96 503 400
Fax: 00 36 96 503 461
E-mail:nagy327@freemail.hu, horvathp@sze.hu