



# Document details

[< Back to results](#) | 1 of 1

[↗ Export](#) [↓ Download](#) [🖨 Print](#) [✉ E-mail](#) [📄 Save to PDF](#) [★ Add to List](#) [More... >](#)

International Journal of Mechanical and Mechatronics Engineering  
Volume 20, Issue 1, 1 February 2020, Pages 80-87

## Quantitative roughness characterization of non-gaussian random rough surfaces by ultrasonic method using pitch-catch and pulse-echo configurations (Article)

Saniman, M.N.F.<sup>a</sup> , Wahid, K.A.A.<sup>a</sup>, Foudzi, F.M.<sup>b</sup>, Ladin, H.H.<sup>c</sup>, Ihara, I.<sup>d</sup> 

<sup>a</sup>Mechanical Engineering Section, Universiti Kuala Lumpur Malaysia France Institute, Bangi, Selangor, 43650, Malaysia


<sup>b</sup>Mechanical Engineering Programme, Faculty of Engineering and Built Environment, Universiti Kebangsaan Malaysia, Bangi, Selangor, 43650, Malaysia

<sup>c</sup>Department of Mechanical Engineering, Kulliyyah of Engineering, International Islamic University Malaysia, Gombak, Selangor, 53100, Malaysia

[View additional affiliations](#) 

[Metrics](#)  [View all metrics >](#)



PlumX Metrics 

Usage, Captures, Mentions, Social Media and Citations beyond Scopus.

Cited by 0 documents

Inform me when this document is cited in Scopus:

[Set citation alert >](#)

## Abstract

∨ View references (32)

Fundamental study to quantitatively evaluate not only the root-mean-square (rms) roughness  $R_q$  but also skewness  $R_{sk}$  of non-Gaussian random rough surfaces by ultrasonic method is presented. In this work, Johnson distribution together with Kirchhoff theory have been employed to derive a newly proposed Johnson characteristic function, which provides a theoretical relationship among ultrasonic reflection coefficient,  $R_q$  and  $R_{sk}$ . Based on the characteristics of such relationship, an effective ultrasonic measurement method consisting of a pitch-catch and a pulse-echo configuration to quantitatively characterize  $R_q$  and  $R_{sk}$  has been proposed. A general guideline for such characterization method has also been suggested. The validation of the proposed method has then been conducted numerically in the case of an air-coupled ultrasound. Good agreements between the numerically estimated  $R_q$  and  $R_{sk}$  and the corresponding reference values thus confirm the validity of the proposed method. © February 2020 IJENS.

## SciVal Topic Prominence

Topic: Roughness Measurement | Surface Roughness | Stylus

Prominence percentile: 81.491 

## Author keywords

Johnson characteristic function | Kirchhoff theory | Non-gaussian | Skewness | Surface roughness | Ultrasonic

## Funding details

Funding sponsor	Funding number	Acronym
-----------------	----------------	---------

Universiti Kuala Lumpur		
-------------------------	--	--

Japan Society for the Promotion of Science See opportunities by JSPS 		JSPS
---	--	------

## Related documents

Ultrasonic roughness measurement based on scattering attenuation

Lian, M. , Liu, H. , Zhou, L. (2019) *Surface Topography: Metrology and Properties*

Application of air-coupled ultrasound to noncontact evaluation of paper surface roughness

Saniman, M.N.F. , Ihara, I. (2014) *Journal of Physics: Conference Series*

Numerical Simulation Method of Rough Surfaces Based on Random Switching System

Wang, T. , Wang, L. , Zheng, D. (2015) *Journal of Tribology*

View all related documents based on references

Find more related documents in Scopus based on:

Authors > Keywords >

## Funding text

Financial support through Grants-in-Aid for Scientific Research (B25289238) from the Japan Society for the Promotion of Science is greatly appreciated. Technical support from Universiti Kuala Lumpur Malaysia France Institute is also appreciated.

---

**ISSN:** 22272771

**Source Type:** Journal

**Original language:** English




**Document Type:** Article

**Publisher:** International Journals of Engineering and Sciences  
Publisher

---

## References (32)

[View in search results format >](#)

All    [Export](#)     [Print](#)     [E-mail](#)     [Save to PDF](#)    [Create bibliography](#)

1    Whitehouse, D.J.  
(2010) *Handbook of Surface and Nanometrology*. Cited 327 times.  
2nd ed. Boca Raton: CRC Press

---

2    Thomas, T.R.  
(1999) *Rough Surfaces*, p. 278. Cited 756 times.  
2nd ed. London: Imperial College Press

---

- 
- 3 Sutowski, P., Nadolny, K., Ungureanu, M., Kaplonek, W.  
Stylus Profilometry in Surface Roughness Measurements of the Vertical Conical Mixing Unit Used in a Food Industry  
(2018) *Journal of Mechanical Engineering*, 47 (1), pp. 1-8. Cited 5 times.

- 
- 4 Sukmana, D.D., Ihara, I.  
Application of Air-Coupled Ultrasound to Noncontact Surface Roughness Evaluation  
(2005) *Japanese Journal of Applied Physics*, 44 (6), pp. 4417-4420. Cited 24 times.

- 
- 5 Sukmana, D.D., Ihara, I.  
Surface roughness characterization through the use of diffuse component of scattered air-coupled ultrasound  
  
(2006) *Japanese Journal of Applied Physics, Part 1: Regular Papers and Short Notes and Review Papers*, 45 (5 B), pp. 4534-4540. Cited 22 times.  
<http://jjap.ipap.jp/link?JJAP/45/4534/pdf>  
doi: 10.1143/JJAP.45.4534

View at Publisher

---

- 
- 6 Sukmana, D.D., Ihara, I.  
Quantitative evaluation of two kinds of surface roughness parameters using air-coupled ultrasound
- (2007) *Japanese Journal of Applied Physics, Part 1: Regular Papers and Short Notes and Review Papers*, 46 (7 B), pp. 4508-4513. Cited 12 times.  
<http://jjap.ipap.jp/link?JJAP/46/4508/pdf>  
doi: 10.1143/JJAP.46.4508
- [View at Publisher](#)
- 
- 7 Fang, Y., Lin, L., Feng, H., Lu, Z., Emms, G.W.  
Review of the use of air-coupled ultrasonic technologies for nondestructive testing of wood and wood products
- (2017) *Computers and Electronics in Agriculture*, 137, pp. 79-87. Cited 34 times.  
[www.elsevier.com/inca/publications/store/5/0/3/3/0/4](http://www.elsevier.com/inca/publications/store/5/0/3/3/0/4)  
doi: 10.1016/j.compag.2017.03.015
- [View at Publisher](#)
- 
- 8 Lian, M., Liu, H., Zhou, L., Zhang, T., Liu, B., Wang, Y.  
Ultrasonic roughness measurement based on scattering attenuation
- (2019) *Surface Topography: Metrology and Properties*, 7 (1), art. no. 015001. Cited 2 times.  
<https://iopscience.iop.org/article/10.1088/2051-672X/aafa4f/pdf>  
doi: 10.1088/2051-672X/aafa4f
- [View at Publisher](#)
-

- 
- 9 Kamigaki, T., Nakatsuma, K., Oshima, Y., Torigoe, I.  
Detection of ultrasound pressure distribution for remote measurement of haptic surface roughness

(2015) *2015 IEEE SENSORS - Proceedings*, art. no. 7370243.

ISBN: 978-147998202-8

doi: 10.1109/ICSENS.2015.7370243

[View at Publisher](#)

---

- 10 Zukauskas, E., Raisutis, R., Voleisis, A., Vladisauskas, A., Kairiukstis, L.  
Investigation of the quality of the surface of wood lamellas using air-coupled ultrasonic technique  
(2008) *Ultragarsas*, 63 (3), pp. 33-37. Cited 3 times.

- 
- 11 Arunachalam, N., Anand Kumar, R., Ramamoorthy, B.  
A preliminary investigation on the application of air-coupled ultrasound to evaluate surface condition of the grinding wheel

(2011) *International Journal of Abrasive Technology*, 4 (3), pp. 266-278.

<http://www.inderscience.com/ijat>

doi: 10.1504/IJAT.2011.042823

[View at Publisher](#)

---

- 
- 12 Saniman, M.N.F., Ihara, I.

Application of air-coupled ultrasound to noncontact evaluation of paper surface roughness ([Open Access](#))

(2014) *Journal of Physics: Conference Series*, 520 (1), art. no. 012016. Cited 3 times.

<http://www.iop.org/EJ/journal/conf>

doi: 10.1088/1742-6596/520/1/012016

[View at Publisher](#)

---

- 13 Yu, N., Polycarpou, A.A.

Contact of rough surfaces with asymmetric distribution of asperity heights

(2002) *Journal of Tribology*, 124 (2), pp. 367-376. Cited 100 times.

doi: 10.1115/1.1403458

[View at Publisher](#)

---

- 14 Podgornik, B., Vilhena, L.M., Sedlaček, M., Rek, Z., Žun, I.

Effectiveness and design of surface texturing for different lubrication regimes

(2012) *Meccanica*, 47 (7), pp. 1613-1622. Cited 74 times.

doi: 10.1007/s11012-012-9540-7

[View at Publisher](#)

---

- 
- 15 Chang, L., Jeng, Y.-R.  
Effects of negative skewness of surface roughness on the contact and lubrication of nominally flat metallic surfaces

(2013) *Proceedings of the Institution of Mechanical Engineers, Part J: Journal of Engineering Tribology*, 227 (6), pp. 559-569. Cited 14 times.  
doi: 10.1177/1350650112465365

[View at Publisher](#)

---

- 16 Yan, X.-L., Wang, X.-L., Zhang, Y.-Y.  
Influence of roughness parameters skewness and kurtosis on fatigue life under mixed elastohydrodynamic lubrication point contacts

(2014) *Journal of Tribology*, 136 (3), art. no. 031503. Cited 19 times.  
<http://asmedl.aip.org/Tribology>  
doi: 10.1115/1.4027480

[View at Publisher](#)

---

- 17 Kang, Y.S., Hager, C.H., Evans, R.D.  
Effects of skewed surface textures on lubricant film thickness and traction

(2015) *Tribology Transactions*, 58 (3), pp. 397-406. Cited 13 times.  
[www.tandf.co.uk/journals/titles/10402004.asp](http://www.tandf.co.uk/journals/titles/10402004.asp)  
doi: 10.1080/10402004.2014.980592

[View at Publisher](#)

---



- 
- 18 Sedlaček, M., Vilhena, L.M.S., Podgornik, B., Vižintin, J.  
Surface topography modelling for reduced friction ([Open Access](#))  
  
(2011) *Strojniski Vestnik/Journal of Mechanical Engineering*, 57 (9), pp. 674-680. Cited 54 times.  
[http://en.sv-jme.eu/data/upload/2011/09/05\\_2010\\_140\\_Sedlacek\\_05O.pdf](http://en.sv-jme.eu/data/upload/2011/09/05_2010_140_Sedlacek_05O.pdf)  
doi: 10.5545/sv-jme.2010.140  
  
View at Publisher
- 
- 19 Stout, K.J.  
Surface roughness ~ measurement, interpretation and significance of data  
  
(1981) *Materials and Design*, 2 (5), p. 260. Cited 8 times.  
doi: 10.1016/0261-3069(81)90069-8  
  
View at Publisher
- 
- 20 Ogilvy, J.A., Merklinger, H.M.  
Theory of Wave Scattering from Random Rough Surfaces  
(1991) *The Journal of the Acoustical Society of America*, 90 (6), pp. 3382-3382. Cited 28 times.
- 
- 21 Shi, F., Lowe, M.J.S., Xi, X., Craster, R.V.  
Diffuse scattered field of elastic waves from randomly rough surfaces using an analytical Kirchhoff theory  
  
(2016) *Journal of the Mechanics and Physics of Solids*, 92, pp. 260-277. Cited 16 times.  
doi: 10.1016/j.jmps.2016.04.003  
  
View at Publisher
- 
-

- 
- 22 Velichko, A., Bai, L., Drinkwater, B.W.  
Ultrasonic defect characterization using parametric-manifold mapping  
(2017) *Proceedings of the Royal Society A: Mathematical, Physical and Engineering Sciences*, 473 (2202). Cited 13 times.
- 
- 23 Gadelmawla, E.S., Koura, M.M., Maksoud, T.M.A., Elewa, I.M., Soliman, H.H.  
Roughness parameters  
  
(2002) *Journal of Materials Processing Technology*, 123 (1), pp. 133-145. Cited 1136 times.  
doi: 10.1016/S0924-0136(02)00060-2  
  
[View at Publisher](#)
- 
- 24 JOHNSON, N.L.  
Systems of frequency curves generated by methods of translation.  
  
(1949) *Biometrika*, 36 (Pt. 1-2), pp. 149-176. Cited 1184 times.  
doi: 10.1093/biomet/36.1-2.149  
  
[View at Publisher](#)
- 
- 25 Tuentner, H.J.H.  
An algorithm to determine the parameters of  $S_U$ -curves in the Johnson system of probability distributions by moment matching  
  
(2001) *Journal of Statistical Computation and Simulation*, 70 (4), pp. 325-347. Cited 13 times.  
<http://www.tandf.co.uk/journals/titles/00949655.html>  
doi: 10.1080/00949650108812126  
  
[View at Publisher](#)
-

- 
- 26 Saniman, M.N.F., Ihara, I.  
Feasibility study on characterization of non-Gaussian rough surface by ultrasonic reflection method with the Kirchhoff theory  
(2016) *Mechanical Engineering Journal*, 3 (6), pp. 16-00162.

- 
- 27 Harvey, J.E., Krywonos, A., Vernold, C.L.  
Modified Beckmann-Kirchhoff scattering model for rough surfaces with large incident and scattering angles ([Open Access](#))

(2007) *Optical Engineering*, 46 (7), art. no. 078002. Cited 48 times.  
doi: 10.1117/1.2752180

[View at Publisher](#)

- 
- 28 Zhang, S., Wang, W., Zhao, Z.  
The effect of surface roughness characteristics on the elastic-plastic contact performance

(2014) *Tribology International*, 79, pp. 59-73. Cited 30 times.  
[www.elsevier.com/inca/publications/store/3/0/4/7/4](http://www.elsevier.com/inca/publications/store/3/0/4/7/4)  
doi: 10.1016/j.triboint.2014.05.016

[View at Publisher](#)

---

- 
- 29 Pawar, G., Pawlus, P., Etsion, I., Raeymaekers, B.

The effect of determining topography parameters on analyzing elastic contact between isotropic rough surfaces ([Open Access](#))

(2013) *Journal of Tribology*, 135 (1), art. no. 011401. Cited 45 times.  
doi: 10.1115/1.4007760

[View at Publisher](#)

---

- 30 Ghosh, A., Sadeghi, F.

A novel approach to model effects of surface roughness parameters on wear

(2015) *Wear*, 338-339, pp. 73-94. Cited 39 times.  
doi: 10.1016/j.wear.2015.04.022

[View at Publisher](#)

---

- 31 Wu, J.-J.

Simulation of non-Gaussian surfaces with FFT

(2004) *Tribology International*, 37 (4), pp. 339-346. Cited 89 times.  
[www.elsevier.com/inca/publications/store/3/0/4/7/4](http://www.elsevier.com/inca/publications/store/3/0/4/7/4)  
doi: 10.1016/j.triboint.2003.11.005

[View at Publisher](#)

---

□ 32 Ogilvy, J.A.

## Computer simulation of acoustic wave scattering from rough surfaces

(1988) *Journal of Physics D: Applied Physics*, 21 (2), pp. 260-277. Cited 51 times.  
doi: 10.1088/0022-3727/21/2/006

[View at Publisher](#)

👤 Saniman, M.N.F.; Mechanical Engineering Section, Universiti Kuala Lumpur Malaysia France Institute, Bangi, Selangor, Malaysia; email:mnfarhan@unikl.edu.my

© Copyright 2020 Elsevier B.V., All rights reserved.

[< Back to results](#) | 1 of 1

[^ Top of page](#)

### About Scopus

[What is Scopus](#)

[Content coverage](#)

[Scopus blog](#)

[Scopus API](#)

[Privacy matters](#)

### Language

[日本語に切り替える](#)

[切换到简体中文](#)

[切换到繁體中文](#)

[Русский язык](#)

### Customer Service

[Help](#)

[Contact us](#)

**ELSEVIER**

[Terms and conditions ↗](#) [Privacy policy ↗](#)

Copyright © Elsevier B.V. ↗. All rights reserved. Scopus® is a registered trademark of Elsevier B.V.

 RELX

We use cookies to help provide and enhance our service and tailor content. By continuing, you agree to the use of cookies.

