Scopus

Documents

Bahadoran, M.[a] , Aghili, A.[b] , Ahmad Noorden, A.F.[c]

Micro-opto-mechanical pressure sensor via ring resonator-based Mach–Zehnder interferometer
(2022) *European Physical Journal Plus*, 137 (4), art. no. 427, .

DOI: 10.1140/epjp/s13360-022-02655-1

[a] Department of Physics, Shiraz University of Technology, Fars, Shiraz, 31371555, Iran
[b] Department of Polymer Engineering, Shiraz Branch, Islamic Azad University, Shiraz, 71987-74731, Iran
[c] Centre for Advanced Optoelectronics Research (CAPTOR), Department of Physics, Kulliyyah of Science, International Islamic University Malaysia, Pahang, Kuantan, 25200, Malaysia

Abstract
A microscale opto-mechanical pressure sensors was studied using a combination design of silicon microring resonator and Mach–Zehnder interferometer placed on the middle of the pliable squared diaphragm fabricated from silicon-polydimethylsiloxane layers. The outward displacement and deflection of the diaphragm in z-directions along the x- and y-axes were calculated using the finite element method. The optical transfer function of proposed layout was derived using the delay line signal approach. The optimum geometrical parameters of the system and a critical coupling condition were determined for pressure sensing application and an extended quasi-FSR as large as 108 nm with quality factor of 4752 was realized. The performance of the sensor in the range of 0–225 kpa was studied based on the spectral shift of output resonance peaks due to the applied shear stress on the diaphragm. The sensitivity and a minimum detectable pressure of proposed is calculated to be 0.38 nm/kPa and 50 pa, respectively. The proposed pressure sensor fulfills the expectations of microscale size, high precision, and high sensitivity, and this sensor potentially can be used as high-performance devices in the precision Instrumentation, aircrafts technology as well as harsh environments.

References

- Xu, X., Yang, Y., Chen, L., Chen, X., Wu, T., Li, Y.
  (2021) *Laser Photonics Rev.*, 15 (6), p. 2000546.

- Zhou, G., Li, W., Zhou, X., Tan, Y., Lin, G., Li, X.
  (2021) *Int. J. Remote Sens.*, 42 (24), pp. 9187-9211.

- Guo, J., Gao, J., Xiao, C., Chen, L., Qian, L.
  (2021) *Friction*,

- Li, H., Tang, J., Kang, Y., Zhao, H., Fang, D., Fang, X.
  (2018) *Appl. Phys. Lett.*, 113 (23), p. 233104.

- Meng, Q., Lai, X., Yan, Z., Su, C.-Y., Wu, M.
  (2021) *IEEE Trans. Neural Netw. Learn. Syst.*,

- Xu, P., Cui, L., Gao, S., Na, N., Ebadi, A.G.
  (2021) *Mol. Phys.*,

- Li, H., Zhang, Y., Li, C., Zhou, Z., Nie, X., Chen, Y.
  (2022) *Int. J. Adv. Manuf. Technol.*,

- Oh, M.-C., Kim, J.-W., Kim, K.-J., Lee, S.-S.
  (2009) *IEEE Photonics Technol. Lett.*, 21 (8), pp. 501-503.

- Sanati, P., Hashemi, S.-S., Bahadoran, M., Babadi, A.A., Akbari, E.
  (2022) *Silicon*, 14 (3), pp. 851-857.
- Seyfari, A.K., Bahadoran, M., Aghili, A.
  (2020) *Opt. Quantum Electron.*, 52 (408), pp. 2-16.
- Li, J., Huang, Q., Yin, R., Ji, W., Gong, Z., Song, Z.
  (2020) *IEEE Sens. J.*, 20 (16), pp. 8903-8911.
- Ioppolo, T., Ötügen, M.V.
  (2007) *JOSA B*, 24 (10), pp. 2721-2726.
- Osório, J.H., Chesini, G., Serrão, V.A., Franco, M.A., Cordeiro, C.M.
  (2017) *Sci. Rep.*, 7 (1), pp. 1-9.
- Chen, X., Zhang, D., Wu, M.
  (2017) *, Presented at the AIP Conference Proceedings*,
  (unpublished)
- Kolli, V.R., Bahaddur, I., Prabhakar, D., Talabattulac, S.
  (2021) *Photonics Nanostruct. Fundam. Appl.*, 43, p. 100870.
- Domingues, M.F., Rodriguez, C.A., Martins, J., Tavares, C., Marques, C., Alberto, N.
  (2018) *Opt. Fiber Technol.*, 42, pp. 56-62.
- Donlagic, D., Cibula, E.
  (2005) *Opt. Lett.*, 30 (16), pp. 2071-2073.
- Udd, E., Spillman, W.B.
  Fiber optic sensors: An introduction for engineers and scientists, Second Edn
  (2011), (John Wiley & Sons Inc
- Pattnaik, P.K., Vijayaaditya, B., Srinivas, T., Selvarajan, A.
  Presented at the 2005 international conference on MEMS,
  NANO and smart systems, 2005 (unpublished)
- Zhao, X., Tsai, J., Cai, H., Ji, X., Zhou, J., Bao, M.
  (2012) *Opt. Express*, 20 (8), pp. 8535-8542.
- Fu, X., Mo, W., Jin, F., Song, J., Dong, K.
  (2019) *J. Mod. Opt.*, 66 (3), pp. 312-321.
- Lee, D.-W., Choi, Y.-S.
  (2008) *Microelectron. Eng.*, 85 (5-6), pp. 1054-1058.
- Chen, X., Wang, D., Wang, T., Yang, Z., Zou, X., Wang, P.
  (2019) *ACS Appl. Mater. Interfaces*, 11 (36), pp. 33188-33193.
- Huang, X., Ma, X., Li, X., Fan, J., Guo, L., Yang, H.
  (2022) *Sci. Rep.*, 12 (1), pp. 1-10.
- Zhou, G., Zhou, X., Song, Y., Xie, D., Wang, L., Yan, G.
  (2021) *Int. J. Remote Sens.*, 42 (10), pp. 3731-3755.
- Noorden, A.F.A., Chaudhary, K., Bahadoran, M., Aziz, M.S., Jalil, M.A., Tiong, O.C.
  (2015) *Optoelectron. Lett.*, 11 (5), pp. 342-347.

- Sirawattananon, C., Bahadoran, M., Ali, J., Mitatha, S., Yupapin, P.P.
  (2012) *IEEE Trans. Nanotechnol.*, 11 (4), pp. 707-712.
- Madsen, C.K., Zhao, J.H.
  (1999) *Optical Filter Design and Analysis: A Signal Processing Approach*,
  (John Wiley & Sons Inc
- Shafiee, A., Bahadoran, M., Yupapin, P.
  (2019) *Appl. Opt.*, 58 (30), pp. 8167-8173.
- Bahadoran, M., Noorden, A.F.A., Mohajer, F.S., Abd Mubin, M.H., Chaudhary, K., Jalil, M.A.
  (2016) *Artif. Cells Nanomed. Biotechnol.*, 44 (1), pp. 315-321.
- Bahadoran, M., Yupapin, P.
  (2018) *Eur. Phys. J. Plus*, 133 (11), p. 487.
- Amiri, I., Zakaria, R., Anwar, T., Bahadoran, M., Vigneswaran, D., Yupapin, P.
  (2018) *Results Phys.*, 11, pp. 1087-1093.
- Mason, S.
  (1956) *Proc. IRE*, 7 (44), pp. 920-926.
- Seyfari, A.K., Bahadoran, M., Yupapin, P.
  (2021) *Nano Commun. Netw.*, 29, p. 100352.
- Bahadoran, M., Yupapin, P., Amiri, I.S.
  (2021) *Microw. Opt. Technol. Lett.*, 63 (2), pp. 653-661.
- Bahadoran, M., Noorden, A.F.A., Chaudhary, K., Aziz, M.S., Ali, J., Yupapin, P.
  (2014) *Measurement*, 58, pp. 215-220.
- Mohamad, A., Bahadoran, M., Noorden, A., Fakhrurrazi, A., Aziz, S., Chaudhary, K.
  (2015) *J. Comput. Theor. Nanosci.*, 12 (10), pp. 3188-3193.
- Bahadoran, M., Aziz, M., Noorden, A., Jalil, M., Ali, J., Yupapin, P.
  (2014) *Dig. J. Nanomater. Biostruct.*, 9 (3), pp. 1095-1104.
- Sanati, P., Shafiee, A., Bahadoran, M., Akbari, E.
  (2020) *Eur. Phys. J. Plus*, 135 (11), p. 869.
- Bahadoran, M., Ali, J., Yupapin, P.P.
  (2013) *Appl. Opt.*, 52 (12), pp. 2866-2873.
- Rabus, D.G., Bian, Z., Shakouri, A.
  (2005) *IEEE Photonics Technol. Lett.*, 17 (9), p. 1770.
- Bahadoran, M., Jalil, M.A., Ali, J., Amiri, I.S., Yupapin, P.
  (2020) *Opt. Quantum Electron.*, 52 (216), pp. 1-14.
- Yariv, A.
  (2002) *IEEE Photonics Technol. Lett.*, 14 (4), pp. 483-485.
- Bahadoran, M., Amiri, I.S.
  (2019) *J. Theor. Appl. Phys.*, 13, pp. 213-220.

- Szilard, R.
  (2004) *Appl. Mech. Rev.*, 57 (6), pp. B32-B33.
- Wang, B., Krause, S.
  (1987) *Macromolecules*, 20 (9), pp. 2201-2208.
- Hopcroft, M.A., Nix, W.D., Kenny, T.W.
  (2010) *J. Microelectromech. Syst.*, 19 (2), pp. 229-238.
- Hallynck, E., Bienstman, P.
  (2012) *IEEE Photonics J.*, 4 (2), pp. 443-450.
- Li, X., Guo, S.-L., Li, Z.-Q., Yang, M.
  (2014) *Optoelectron. Lett.*, 10 (3), pp. 188-190.

Correspondence Address
Bahadoran M.; Department of Physics, Fars, Iran; email: bahadoran@sutech.ac.ir

Publisher: Springer Science and Business Media Deutschland GmbH

ISSN: 21905444
Language of Original Document: English
Abbreviated Source Title: Eur. Phys. J. Plus
2-s2.0-85128011048
Document Type: Article
Publication Stage: Final
Source: Scopus