Micromachined Tactile Sensor for Soft-Tissue

Ahmed M. R. Fath El Bab, Koji Sugano, Toshiyuki Tsuchiya, Member, IEEE, Osamu Tabata, Senior Member, IEEE,

Abstract:

Compliance detection becomes very essential in minimally invasive surgery (MIS). It can help in detection of cancerous lumps and/or for deciding on tissue healthiness. In this paper, a micromachined piezoresistive tactile sensor, with two serpentine springs and 500-μm cubic mesas, has been designed for detecting the compliance of soft tissue independent of the applied distance between the sensor and the tissue. The measuring range of the sensor is chosen to be associated with the soft-tissue properties. The sensor parameters are optimized to give high sensitivity and linearity of the sensor output. The design is simulated using ANSYS for checking the sensor performance. Then, the sensor is fabricated and tested by three types of specimens, namely, specimen chips with known stiffness, silicone rubber specimens, and chicken organ specimens (leg and heart). For the specimen chips and silicone rubber specimens, the sensor distinguished between different stiffnesses independent of the applied displacement in the range of 50–200 μm. The sensor measured Young’s modulus up to 808 kPa with an average error of ±7.25%. For the chicken leg and heart, the sensor distinguished between them under the applied displacement from 100 to 200 μm, and they were calculated as 12 ± 1 kPa and 81 ± 8 kPa, respectively.

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JOURNAL OF MICROELECTROMECHANICAL SYSTEMS, Vol. 21 - No. 3,
(2)

ANFIS Based Jacobian for a Parallel Manipulator Mobility

Ahmed Asker, Omar Salah, Ahmed Fath El-Bab, Ahmed Ramadan, Samy Assal, Salvatore Sessa and Ahmed Abo-Ismail

Abstract:

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Keywords:

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Published In:

in IEEE 2014 UKACC 10th International Conference on Control (Control 2014), U.K., NULL, NULL
Modeling and simulation for support robot tracking a human sit to stand motion

Omar Salah, Salvatore SESSA, Ahmed M. R. Fath El-Bab, Yo Kobayashi, Atsuo Takanishi, and Makasatsu Fujie

Abstract:

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Keywords:

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Published In:

IEEE 28th International Conference on Microelectronics "ICM 2016", NULL, NULL
Discontinuous Stabilizing Control of Skid-Steering Mobile Robot (SSMR)

Ibrahim, Fady; Abouelsoud, A.A.; Fath El Bab, Ahmed M. R.; Ogata, Tetsuya

Abstract:

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Keywords:

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Published In:

Modeling and experimental testing of three-tip configuration tactile sensor for compensating the error due to soft tissue surface irregularities during stiffness detection

Fouly, Ahmed; FathEl-Bab, Ahmed M.R.; Nasr, Mohamed N.A.; Abouelsoud, A.A.

Abstract:

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Keywords:

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Published In:

Measurement: Journal of the International Measurement Confederation, v 98, p 112-122
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A novel SMA-based micro tactile display device for elasticity range of human soft tissues: Design and simulation

Mansour, Nader A.; Fath El-Bab, Ahmed M.R.; Assal, Samy F.M.

Abstract:

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Keywords:

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Published In:

IEEE/ASME International Conference on Advanced Intelligent Mechatronics, AIM, NULL, p 447-452
A comparative study of Extended Kalman Filter and H filter for state estimation of stewart platform manipulator

Maged, Shady A.; Abouelsoud, A.A.; El Bab, Ahmed M.R. Fath; Namerikawa, Toru

Abstract:

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Keywords:

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Published In:

2016 55th Annual Conference of the Society of Instrument and Control Engineers of Japan, SICE 2016 , NULL , NULL
( 8 )

Error Source Identification in Measuring Soft Tissue Stiffness and Self Compensating This Error Using Three Probes Configuration

Fouly, Ahmed; Fath El Bab, Ahmed M. R.; Abouelsoud, A.A.; Nasr, Mohamed N. A.

Abstract:

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Keywords:

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Published In:

Proceedings - International Conference on Intelligent Systems, Modelling and Simulation, ISMS , NULL , p 440-445
Design, characterization and control of SMA springs-based multi-modal tactile display device for biomedical applications

Mansour, Nader A.; Fath El-Bab, Ahmed M.R.; Assal, Samy F.M.; Tabata, Osamu

Abstract:

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Published In:

Mechatronics, v 31, p 255-263
Ultrahigh-sensitivity graphene-based strain gauge sensor: Fabrication on Si/SiO2 and first-principles simulation

Gamil, Mohammed; Fath El-Bab, Ahmed M. R.; El-Moneim, Ahmed Abd; Nakamura, Koichi

Abstract:

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Keywords:

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Published In:

Sensors and Materials, v 30, n 9, p 2085-2100
Design and modeling of micro tactile sensor with three contact tips for self-compensation of contact error in soft tissue elasticity measurement

Fouly, Ahmed; Nasr, Mohamed N.A.; Fath El Bab, Ahmed M.R.; Abouelsoud, A.A.

Abstract:

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Keywords:

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Published In:

IEEJ Transactions on Electrical and Electronic Engineering, v 10, p S144-S150
Graphene film development on flexible substrate using a new technique: Temperature dependency of gauge factor for graphene-based strain sensors

Sayed, Sahour; Gamil, Mohammed; El-Bab, Ahmed Fath; Nakamura, Koichi; Tsuchiya, Toshiyuki; Tabata, Osamu; El-Moneim, Ahmed Abd

Abstract:

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Keywords:

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Published In:

Sensor Review, v 36, n 2, p 140-147
Estimation of landmine characteristics in sandy desert using neural networks

Ali, Hussein F. M.; Fath El-Bab, Ahmed M. R.; Zyada, Zakarya; Megahed, Said M.

Abstract:

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Keywords:

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Published In:

Neural Computing and Applications. v 28, n 7, p 1801-1815
Design, Modeling and Simulation of a Micro Tactile Sensor for Soft Tissue Stiffness Measurement with Three Tips Configuration

Fouly, Ahmed; Nasr, Mohamed N.A.; El Bab, Ahmed M.R. Fath; Abouelsoud, A.A.

Abstract:

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Keywords:

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Published In:

Proceedings of International Conference on Computational Intelligence, Modelling and Simulation, NULL, p 155-160
Adaptive formation control of robot swarms using optimized potential field method

Elkilany, Basma Gh.; Abouelsoud, A.A.; Fathelbab, Ahmed M.R.

Abstract:

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Keywords:

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Published In:

Proceedings of the IEEE International Conference on Industrial Technology, v 0, p 721-725
Tackling Dead End Scenarios by Improving Follow Gap Method with Genetic Programming

Abdelwhab, Mohamed; Abouelsoud, A.A.; Elbab, Ahmed M. R. Fath

Abstract:

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Keywords:

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Published In:

2018 57th Annual Conference of the Society of Instrument and Control Engineers of Japan, SICE 2018, NULL, p 1566-1571
An adaptive observer for a Stewart platform manipulator using leg position and force measurements

Maged, Shady A.; Fath El Bab, Ahmed M.R.; Abouelsoud, A.A.

Abstract:

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Keywords:

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Published In:

International Journal of Modelling, Identification and Control, v 24, n 1, p 62-74
Fuzzy logic-based PI controller design and implementation of shape memory alloy actuator

Alsayed, Yasser M.; Abouelsoud, A.A.; Fath El Bab, Ahmed M.R.

Abstract:

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Keywords:

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Published In:

International Journal of Automation and Control, v 12, n 3, p 427-448
Stewart Platform Manipulator: State Estimation Using Inertia Sensors and Unscented Kalman Filter

Maged, Shady A.; Abouelsoud, A.A.; Bab, Ahmed M. R. Fath El; Namerikawa, Toru

Abstract:

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Keywords:

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Published In:

A proposed formation control algorithm for robot swarm based on adaptive fuzzy potential field method

Elkilany, Basma Gh.; Abouelsoud, A.A.; Fathelbab, Ahmed M.R.; Ishii, Hiroyuki

Abstract:

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Keywords:

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Published In:

Proceedings: IECON 2018 - 44th Annual Conference of the IEEE Industrial Electronics Society, NULL, p 2189-2194
A comparative study of unscented and extended Kalman filter for position and velocity estimation of Stewart platform manipulator

Maged, Shady. A.; Abouelsoud, A.A.; Bab, Ahmed M.R. Fath El

Abstract:

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Keywords:

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Published In:

5th Annual IEEE International Conference on Cyber Technology in Automation, Control and Intelligent Systems, IEEE-CYBER 2015, NULL, NULL