

ISSN 1726-5749

SENSORS & TRANSDUCERS

vol. 78
4/07



MEMS and Modern Technologies

International Frequency Sensor Association Publishing





Sensors & Transducers

Volume 78
Issue 4
April 2007

www.sensorsportal.com

ISSN 1726-5479

Editor-in-Chief: professor Sergey Y. Yurish, phone: +34 696067716, fax: +34 93 4011989,
e-mail: editor@sensorsportal.com

Editors for Western Europe

Meijer, Gerard C.M., Delft University of Technology, The Netherlands
Ferrari, Vittorio, Università di Brescia, Italy

Editors for North America

Datskos, Panos G., Oak Ridge National Laboratory, USA
Fabien, J. Josse, Marquette University, USA
Katz, Evgeny, Clarkson University, USA

Editor South America

Costa-Felix, Rodrigo, Inmetro, Brazil

Editor for Eastern Europe

Sachenko, Anatoly, Ternopil State Economic University, Ukraine

Editor for Asia

Ohyama, Shinji, Tokyo Institute of Technology, Japan

Editorial Advisory Board

- Abdul Rahim, Ruzairi**, Universiti Teknologi, Malaysia
Ahmad, Mohd Noor, Nothern University of Engineering, Malaysia
Annamalai, Karthigeyan, National Institute of Advanced Industrial Science and Technology, Japan
Arcega, Francisco, University of Zaragoza, Spain
Arguel, Philippe, CNRS, France
Ahn, Jae-Pyoung, Korea Institute of Science and Technology, Korea
Arndt, Michael, Robert Bosch GmbH, Germany
Ascoli, Giorgio, George Mason University, USA
Atalay, Selcuk, Inonu University, Turkey
Atghiaee, Ahmad, University of Tehran, Iran
Augutis, Vygantas, Kaunas University of Technology, Lithuania
Avachit, Patil Lalchand, North Maharashtra University, India
Ayesh, Aladdin, De Montfort University, UK
Bahreyni, Behraad, University of Manitoba, Canada
Baoxian, Ye, Zhengzhou University, China
Barford, Lee, Agilent Laboratories, USA
Barlingay, Ravindra, Priyadarshini College of Engineering and Architecture, India
Basu, Sukumar, Jadavpur University, India
Beck, Stephen, University of Sheffield, UK
Ben Bouzid, Sihem, Institut National de Recherche Scientifique, Tunisia
Binnie, T. David, Napier University, UK
Bischoff, Gerlinde, Inst. Analytical Chemistry, Germany
Bodas, Dhananjay, IMTEK, Germany
Borges Carval, Nuno, Universidade de Aveiro, Portugal
Bousbia-Salah, Mounir, University of Annaba, Algeria
Bouvet, Marcel, CNRS – UPMC, France
Brudzewski, Kazimierz, Warsaw University of Technology, Poland
Cai, Chenxin, Nanjing Normal University, China
Cai, Qingyun, Hunan University, China
Campanella, Luigi, University La Sapienza, Italy
Carvalho, Vitor, Minho University, Portugal
Cecelja, Franjo, Brunel University, London, UK
Cerda Belmonte, Judith, Imperial College London, UK
Chakrabarty, Chandan Kumar, Universiti Tenaga Nasional, Malaysia
Chakravorty, Dipankar, Association for the Cultivation of Science, India
Changhai, Ru, Harbin Engineering University, China
Chaudhari, Gajanan, Shri Shivaji Science College, India
Chen, Rongshun, National Tsing Hua University, Taiwan
Cheng, Kuo-Sheng, National Cheng Kung University, Taiwan
Chiriac, Horia, National Institute of Research and Development, Romania
Chowdhuri, Arijit, University of Delhi, India
Chung, Wen-Yaw, Chung Yuan Christian University, Taiwan
Corres, Jesus, Universidad Publica de Navarra, Spain
Cortes, Camilo A., Universidad de La Salle, Colombia
Courtois, Christian, Universite de Valenciennes, France
Cusano, Andrea, University of Sannio, Italy
D'Amico, Arnaldo, Università di Tor Vergata, Italy
De Stefano, Luca, Institute for Microelectronics and Microsystem, Italy
Deshmukh, Kiran, Shri Shivaji Mahavidyalaya, Barshi, India
Kang, Moonho, Sunmoon University, Korea South
Dickert, Franz L., Vienna University, Austria
Dieguez, Angel, University of Barcelona, Spain
Dimitropoulos, Panos, University of Thessaly, Greece
Ding Jian, Ning, Jiangsu University, China
Djordjevich, Alexandar, City University of Hong Kong, Hong Kong
Donato, Nicola, University of Messina, Italy
Donato, Patricio, Universidad de Mar del Plata, Argentina
Dong, Feng, Tianjin University, China
Drljaca, Predrag, Instersema Sensoric SA, Switzerland
Dubey, Venketesh, Bournemouth University, UK
Enderle, Stefan, University of Ulm and KTB mechatronics GmbH, Germany
Erdem, Gursan K. Arzum, Ege University, Turkey
Erkmen, Aydan M., Middle East Technical University, Turkey
Estelle, Patrice, Insa Rennes, France
Estrada, Horacio, University of North Carolina, USA
Faiz, Adil, INSA Lyon, France
Fericean, Sorin, Balluff GmbH, Germany
Fernandes, Joana M., University of Porto, Portugal
Francioso, Luca, CNR-IMM Institute for Microelectronics and Microsystems, Italy
Fu, Weiling, South-Western Hospital, Chongqing, China
Gaura, Elena, Coventry University, UK
Geng, Yanfeng, China University of Petroleum, China
Gole, James, Georgia Institute of Technology, USA
Gong, Hao, National University of Singapore, Singapore
Gonzalez de la Ros, Juan Jose, University of Cadiz, Spain
Granell, Annette, Goteborg University, Sweden
Graff, Mason, The University of Texas at Arlington, USA
Guan, Shan, Eastman Kodak, USA
Guillet, Bruno, University of Caen, France
Guo, Zhen, New Jersey Institute of Technology, USA
Gupta, Narendra Kumar, Napier University, UK
Hadjiloucas, Sillas, The University of Reading, UK
Hashsham, Syed, Michigan State University, USA
Hernandez, Alvaro, University of Alcalá, Spain
Hernandez, Wilmar, Universidad Politecnica de Madrid, Spain
Homentcovschi, Dorel, SUNY Binghamton, USA
Horstman, Tom, U.S. Automation Group, LLC, USA
Hsiai, Tzung (John), University of Southern California, USA
Huang, Jeng-Sheng, Chung Yuan Christian University, Taiwan
Huang, Star, National Tsing Hua University, Taiwan
Huang, Wei, PSG Design Center, USA
Hui, David, University of New Orleans, USA
Jaffrezic-Renault, Nicole, Ecole Centrale de Lyon, France
Jaime Calvo-Galleg, Jaime, Universidad de Salamanca, Spain
James, Daniel, Griffith University, Australia
Janting, Jakob, DELTA Danish Electronics, Denmark
Jiang, Liudi, University of Southampton, UK
Jiao, Zheng, Shanghai University, China
John, Joachim, IMEC, Belgium
Kalach, Andrew, Voronezh Institute of Ministry of Interior, Russia

Kaniasus, Eugenijus, Vienna University of Technology, Austria
Katake, Anup, Texas A&M University, USA
Kausel, Wilfried, University of Music, Vienna, Austria
Kavasoglu, Nese, Mugla University, Turkey
Ke, Cathy, Tyndall National Institute, Ireland
Khan, Asif, Aligarh Muslim University, Aligarh, India
Kim, Min Young, Koh Young Technology, Inc., Korea South
Ko, Sang Choon, Electronics and Telecommunications Research Institute, Korea South
Kockar, Hakan, Balikesir University, Turkey
Kotulska, Malgorzata, Wroclaw University of Technology, Poland
Kratz, Henrik, Uppsala University, Sweden
Kumar, Arun, University of South Florida, USA
Kumar, Subodh, National Physical Laboratory, India
Kung, Chih-Hsien, Chang-Jung Christian University, Taiwan
Lacnjevac, Caslav, University of Belgrade, Serbia
Laurent, Francis, IMEC, Belgium
Lay-Ekuakille, Aime, University of Lecce, Italy
Lee, Jang Myung, Pusan National University, Korea South
Li, Genxi, Nanjing University, China
Li, Hui, Shanghai Jiaotong University, China
Li, Xian-Fang, Central South University, China
Liang, Yuanchang, University of Washington, USA
Liawruangrath, Saisunee, Chiang Mai University, Thailand
Liew, Kim Meow, City University of Hong Kong, Hong Kong
Lin, Hermann, National Kaohsiung University, Taiwan
Lin, Paul, Cleveland State University, USA
Linderholm, Pontus, EPFL - Microsystems Laboratory, Switzerland
Liu, Aihua, Michigan State University, USA
Liu Changgeng, Louisiana State University, USA
Liu, Cheng-Hsien, National Tsing Hua University, Taiwan
Liu, Songqin, Southeast University, China
Lodeiro, Carlos, Universidade NOVA de Lisboa, Portugal
Lorenzo, Maria Encarnacio, Universidad Autonoma de Madrid, Spain
Ma, Zhanfang, Northeast Normal University, China
Majstorovic, Vidosav, University of Belgrade, Serbia
Marquez, Alfredo, Centro de Investigacion en Materiales Avanzados, Mexico
Matay, Ladislav, Slovak Academy of Sciences, Slovakia
Mathur, Prafull, National Physical Laboratory, India
Maurya, D.K., Institute of Materials Research and Engineering, Singapore
Mekid, Samir, University of Manchester, UK
Mendes, Paulo, University of Minho, Portugal
Mennell, Julie, Northumbria University, UK
Mi, Bin, Boston Scientific Corporation, USA
Minas, Graca, University of Minho, Portugal
Moghavvemi, Mahmoud, University of Malaya, Malaysia
Mohammadi, Mohammad-Reza, University of Cambridge, UK
Molina Flores, Esteban, Benemirita Universidad Autonoma de Puebla, Mexico
Moradi, Majid, University of Kerman, Iran
Morello, Rosario, DIMET, University "Mediterranea" of Reggio Calabria, Italy
Mounir, Ben Ali, University of Sousse, Tunisia
Mukhopadhyay, Subhas, Massey University, New Zealand
Neelamegam, Periasamy, Sastra Deemed University, India
Neshkova, Milka, Bulgarian Academy of Sciences, Bulgaria
Oberhammer, Joachim, Royal Institute of Technology, Sweden
Ould Lahoucine, University of Guelma, Algeria
Pamidighanta, Sayanu, Bharat Electronics Limited (BEL), India
Pan, Jisheng, Institute of Materials Research & Engineering, Singapore
Park, Joon-Shik, Korea Electronics Technology Institute, Korea South
Pereira, Jose Miguel, Instituto Politecnico de Setebal, Portugal
Petsev, Dimiter, University of New Mexico, USA
Pogacnik, Lea, University of Ljubljana, Slovenia
Post, Michael, National Research Council, Canada
Prance, Robert, University of Sussex, UK
Prasad, Ambika, Gulbarga University, India
Prateepasen, Asa, Kingmoungut's University of Technology, Thailand
Pullini, Daniele, Centro Ricerche FIAT, Italy
Pumera, Martin, National Institute for Materials Science, Japan
Radhakrishnan, S. National Chemical Laboratory, Pune, India
Rajanna, K., Indian Institute of Science, India
Ramadan, Qasem, Institute of Microelectronics, Singapore
Rao, Basuthkar, Tata Inst. of Fundamental Research, India
Reig, Candid, University of Valencia, Spain
Restivo, Maria Teresa, University of Porto, Portugal
Rezazadeh, Ghader, Urmia University, Iran
Robert, Michel, University Henri Poincare, France
Rodriguez, Angel, Universidad Politecnica de Cataluna, Spain
Rothberg, Steve, Loughborough University, UK
Royo, Santiago, Universitat Politecnica de Catalunya, Spain
Sadana, Ajit, University of Mississippi, USA
Sandacci, Serghei, Sensor Technology Ltd., UK
Sapozhnikova, Ksenia, D.I.Mendeleyev Institute for Metrology, Russia
Saxena, Vibha, Bhabha Atomic Research Centre, Mumbai, India
Schneider, John K., Ultra-Scan Corporation, USA
Seif, Selemeni, Alabama A & M University, USA
Seifter, Achim, Los Alamos National Laboratory, USA
Shearwood, Christopher, Nanyang Technological University, Singapore
Shin, Kyuho, Samsung Advanced Institute of Technology, Korea
Shmaliy, Yuriy, Kharkiv National University of Radio Electronics, Ukraine
Silva Girao, Pedro, Technical University of Lisbon Portugal
Slomovitz, Daniel, UTE, Uruguay
Smith, Martin, Open University, UK
Soleymanpour, Ahmad, Damghan Basic Science University, Iran
Somani, Prakash R., Centre for Materials for Electronics Technology, India
Srinivas, Talabattula, Indian Institute of Science, Bangalore, India
Srivastava, Arvind K., Northwestern University
Stefan-van Staden, Raluca-Ioana, University of Pretoria, South Africa
Sumriddetchka, Sarun, National Electronics and Computer Technology Center, Thailand
Sun, Chengliang, Polytechnic University, Hong-Kong
Sun, Dongming, Jilin University, China
Sun, Junhua, Beijing University of Aeronautics and Astronautics, China
Sun, Zhiqiang, Central South University, China
Suri, C. Raman, Institute of Microbial Technology, India
Sysoev, Victor, Saratov State Technical University, Russia
Szewczyk, Roman, Industrial Research Institute for Automation and Measurement, Poland
Tan, Ooi Kiang, Nanyang Technological University, Singapore
Tang, Dianping, Southwest University, China
Tang, Jaw-Luen, National Chung Cheng University, Taiwan
Thumbavanam Pad, Kartik, Carnegie Mellon University, USA
Tsiantos, Vassilios, Technological Educational Institute of Kaval, Greece
Tsigara, Anna, National Hellenic Research Foundation, Greece
Twomey, Karen, University College Cork, Ireland
Valente, Antonio, University, Vila Real, - U.T.A.D., Portugal
Vaseashta, Ashok, Marshall University, USA
Vazques, Carmen, Carlos III University in Madrid, Spain
Vieira, Manuela, Instituto Superior de Engenharia de Lisboa, Portugal
Vigna, Benedetto, STMicroelectronics, Italy
Vrba, Radimir, Brno University of Technology, Czech Republic
Wandelt, Barbara, Technical University of Lodz, Poland
Wang, Jiangping, Xi'an Shiyou University, China
Wang, Kedong, Beihang University, China
Wang, Liang, Advanced Micro Devices, USA
Wang, Mi, University of Leeds, UK
Wang, Shinn-Fwu, Ching Yun University, Taiwan
Wang, Wei-Chih, University of Washington, USA
Wang, Wensheng, University of Pennsylvania, USA
Watson, Steven, Center for NanoSpace Technologies Inc., USA
Weiping, Yan, Dalian University of Technology, China
Wells, Stephen, Southern Company Services, USA
Wolkenberg, Andrzej, Institute of Electron Technology, Poland
Woods, R. Clive, Louisiana State University, USA
Wu, DerHo, National Pingtung University of Science and Technology, Taiwan
Wu, Zhaoyang, Hunan University, China
Xiu Tao, Ge, Chuzhou University, China
Xu, Tao, University of California, Irvine, USA
Yang, Dongfang, National Research Council, Canada
Yang, Wuqiang, The University of Manchester, UK
Ymeti, Aurel, University of Twente, Netherland
Yu, Haihu, Wuhan University of Technology, China
Yufera Garcia, Alberto, Seville University, Spain
Zagnoni, Michele, University of Southampton, UK
Zeni, Luigi, Second University of Naples, Italy
Zhong, Haoxiang, Henan Normal University, China
Zhang, Minglong, Shanghai University, China
Zhang, Qintao, University of California at Berkeley, USA
Zhang, Weiping, Shanghai Jiao Tong University, China
Zhang, Wenming, Shanghai Jiao Tong University, China
Zhou, Zhi-Gang, Tsinghua University, China
Zorzano, Luis, Universidad de La Rioja, Spain
Zourob, Mohammed, University of Cambridge, UK

Contents

Volume 78
Issue 4
April 2007

www.sensorsportal.com

ISSN 1726-5479

Editorial

MEMS Based System-on-Chip and System in Package: New Perspectives

Sergey Y. Yurish..... I

Research Articles

A Novel Control System Design for Vibrational MEMS Gyroscopes

Qing Zheng, Lili Dong, Zhiqiang Gao..... 1073

Modeling Open-Loop MEMS Tunneling Accelerometer Based on Circular Plate

Hossein Jodat Kordlar, Ghader Rezazadeh 1083

A Novel Design of Micromachined Horn Antenna for Millimeter and Sub-millimeter Applications

A. Ansari, E. Abbaspour..... 1093

Investigation of the Pull-in Phenomenon in Drug Delivery Micropump Using Galerkin Method

Ghader Rezazadeh, Tayefe-Rezaei Saber, Ghesmati Jafar, Tahmasebi Ahmadali..... 1098

Application of SnO₂ Nano-powder on MEMS Type Gas Sensors

E. Abbaspour-Sani, M.N. Azarmanesh, M. Nasser, Kh. Farhadi..... 1108

Fabrication of Meso-Porous Gamma-Alumina Films by Sol-Gel and Gel Casting Processes for Making Moisture Sensors

Kalyan Kumar Mistry..... 1114

Autopulsed Mini Fluidic Device

Rachid Khelfaoui, Boumedienne Benyoucef, Brahim, Dennai, Abdelhak Maazouzi..... 1122

Study of Optical Humidity Sensing Properties of Sol-Gel Processed TiO₂ and MgO Films

B. C. Yadav, N. K. Pandey..... 1127

Some Spinel Oxide Compounds as Reducing Gas Sensors

Nicolae Rezlescu, Elena Rezlescu, Florin Tudorache, Paul Dorin Popa..... 1134

Authors are encouraged to submit article in MS Word (doc) and Acrobat (pdf) formats by e-mail: editor@sensorsportal.com
Please visit journal's webpage with preparation instructions: <http://www.sensorsportal.com/HTML/DIGEST/Submission.htm>

Autopulsed Mini Fluidic Device

Rachid KHELFAOUI¹, Boumedienne BENYOUCEF², Brahim, DENNAI³,
Abdelhak MAAZOUZI³

¹LGMT-INSA, 135 avenue de Ranguel, 31077 Toulouse cedex 4, France

²Université d'Abu Bakr Belkaid de Tlemcen, Algérie

³Centre universitaire de Bechar 0800 Algérie

E-mail: Rachid.khelfaoui@insa-toulouse.fr

Received: 16 March 2007 /Accepted: 20 April 2007 /Published: 23 April 2007

Abstract: The fluidic oscillator is a new micro-scale actuator developed for flow control applications. Mixing in micro channels is an important problem because the flow is always laminar flow even though the velocity may be high. The principal constraints when designing a mixer are the flow rate required through that particular section of the micro-device, the fluid properties of the streams to be mixed and the desired level of mixing. This paper describes a new actuator for flow mixing applications with nozzle size equal 1.18 mm. The gas diffusion, mixing is very important operation in the fields of nature and industry. Now, it is desired to improve the mixing. In this paper, first the performance of fluidic oscillator mixer operated by gas is made clear simulation. *Copyright © 2007 IFSA.*

Keywords: Mixture, Diffusion, Oscillator, Mixer auto pulsed.

1. Introduction

A fast micro mixture is essential in many operations employment in the biochemistry analysis, drugs administration, among other biological processes such as the cells handling, enzyme reactions, which require the micro mixer pharmaceutical products. When transverse section dimensions of channel are about ten micrometers, the molecular diffusion can mix two fluids in few seconds. However, when dimensions are about the hundred micrometers, a molecular diffusion based on the process of micro mixer can take ten seconds [1, 2].

In the study of micro total analysis systems and complicated lab-on-a-chip systems that involve mixing, chemical reaction, separation and detection, micro mixers were focused on solving the difficulties of mixing several fluids in micro-scale channels [3, 4]. Among the various types of micro

mixers, active mixers have external power sources for moving components; active micro mixers require complicated fabrication steps. Furthermore, the electrical field and heat generated from the actuators can cause damage to the chemical samples, although active micro mixers can provide rapid mixing. On the other hand, passive micro mixers have the advantage of simple fabrication and easy operation. The absence of heating elements is important for applications where temperature is a very sensitive parameter. This type of micro mixer, however, requires long mixing length. Oscillating fluid flow mixers are inherently logic devices, and the basic measurement performed to monitor its operation is a frequency. In a properly executed flow mixer, the oscillation frequency is proportional to the volumetric flow rate. Several categories and subgroups of oscillator exist, each with a unique shape and particular approach. The oscillation frequency depends on both the transmission time and the switching time [5].

The principle of oscillators is based of a fluid jet, which injected into the oscillator, bends due to small fluctuations towards one of the attachment walls, The fluid flow on the bent side of the jet is restricted and a low-pressure regime is created, which causes the jet to attach to the wall (Coanda effect) [8] This work consists a numerical study of passive mixers auto pulsed form.

2. Approximation Oscillator Frequency

The period of oscillations is determined by the switching time from the attachment wall to another and the transmission time through the feedback channel [5, 8]. The frequency is determined by expression (1):

$$f = \frac{1}{2.(t_s + t_t)}, \tag{1}$$

where f is the frequency (Hz) and t_s , the switching time (s), t_t is the transmission time (s):

$$f = \frac{1}{2.\left(\frac{l}{c} + \frac{\xi.L}{U}\right)}, \tag{2}$$

where l is the length of one feedback loop; c is the speed of sound; L is the nozzle to-splitter distance; and, ξ is an empirical constant ($1 \leq \xi \leq 2$, U the flow velocity).

For gases, the frequency of a bistable feedback oscillator is function of the jet travel time, of the jet switching time, and the acoustic travel time [7]. In a rough approximation is given by expression (3)

$$f = \frac{\sqrt{\gamma.r.T}}{2.(l_b + 2.L_o)}, \tag{3}$$

where $\sqrt{\gamma.r.T} = 340 \text{ m/s}$ for air, and r gas constant, l_b feedback loop length, L_o outlet length.

Table 1: Frequency oscillations device
($l=0,203 \text{ mm}$, $L=0,003 \text{ mm}$, $U= 300 \text{ m/s}$, $l_b=0,203 \text{ mm}$ $L_o=0.030 \text{ mm}$ $\xi = 1,5$)

f W.Gerhard 1969 (Hz)	f Simões 2005 (Hz)	f simulate (Hz)
646	722	934

3. Geometrical Characteristics

The structure of the oscillating mini-mixer proposed in this work consists of tree connected oscillators, as shown below. Fig.1 presents the geometrical characteristics of the mini-fluidic oscillators mixer defined in this work.

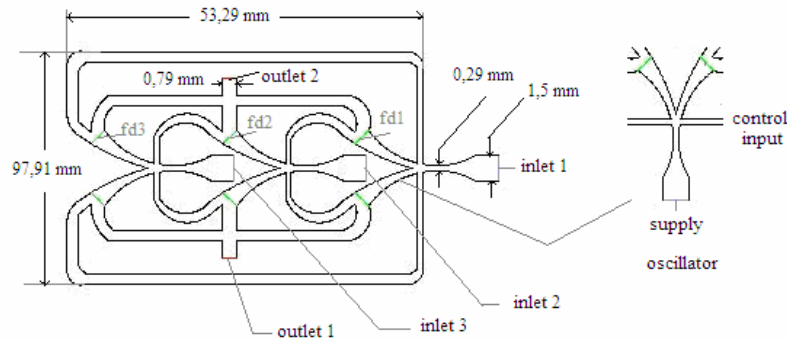


Fig. 1. Schematic representation of the fluidic oscillator mixer.

4. Meshes and Boundary Conditions

In the present simulations, the inlet pressure of three inlets is set in the range 100000 Pa. The fully developed condition is applied to the outlet device. Meanwhile, the boundary condition of the micro chamber wall is specified as a no-slip condition with a zero flux of the sample concentration. This study effectuated discretization under the design criteria Pressure: standards, Pressure speed: Coupling: Simplec, Momentum: first order.

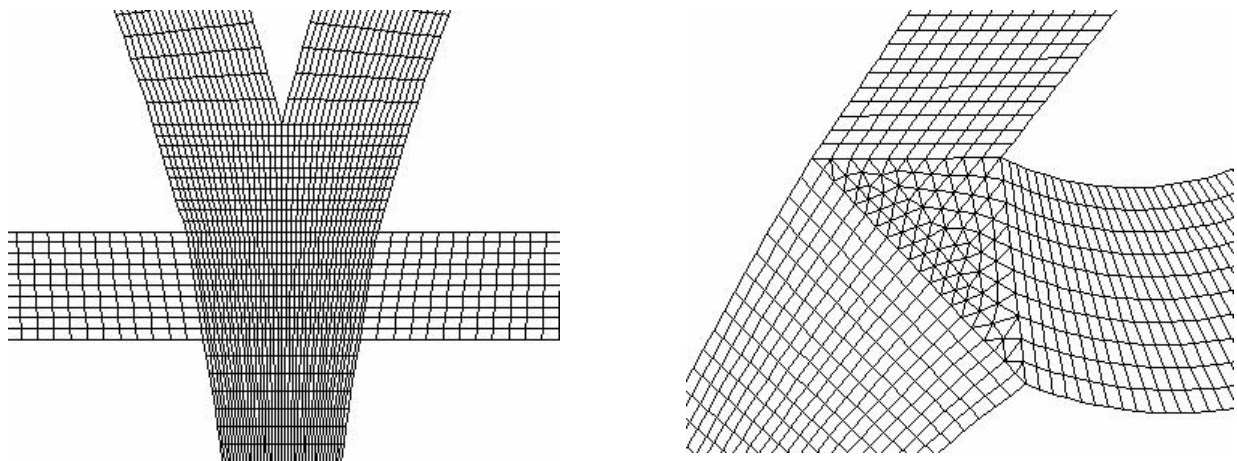


Fig. 2. Meshing representation of the fluidic oscillator (42416 cells).

5. Simulations results

To predicts the local mass fraction of each species, Y_i , through the solution of a convection-diffusion equation for the i^{th} species. This conservation equation takes the following general form:

$$\frac{\partial(\rho Y_i)}{\partial t} + \nabla \cdot (\rho \vec{v} Y_i) = -\nabla \cdot \vec{J}_i + S_i, \tag{4}$$

In first equation J_i is the diffusion flux of species i , which arises due to concentration gradients. By default, we use the dilute approximation, under which the diffusion flux can be written as

$$\vec{J}_i = -\rho D_{i,m} \nabla Y_i, \tag{5}$$

where $D_{i,m}$ is the diffusion coefficient for species i in the mixture.

The flow field of a micro mixer is governed by the compressible Navier–Stokes equations. The following numerical results are obtained for air and turbulent regime, in this study, the Reynolds number is defined as $Re = \frac{V \cdot d}{\nu}$ where d is the inlet channels size and V is the velocity inlet, and ν the cinematic viscosity. The Reynolds number at nozzle is equal 20046, for millimetric sizes.

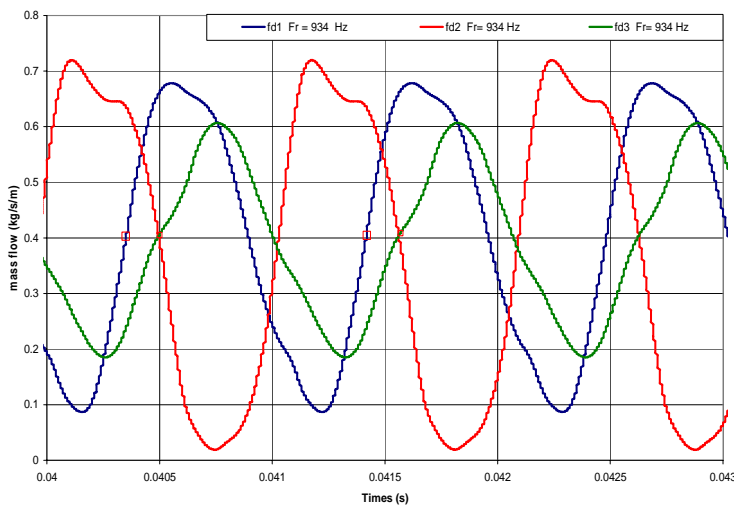


Fig. 3. Mass flow through the right branches feedback loops.

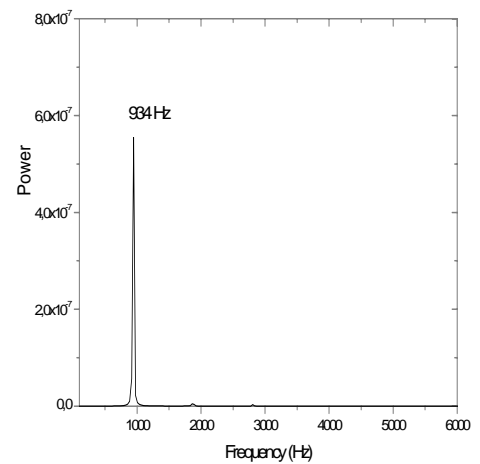


Fig. 4. FFT mass flow through the right branch fd1.

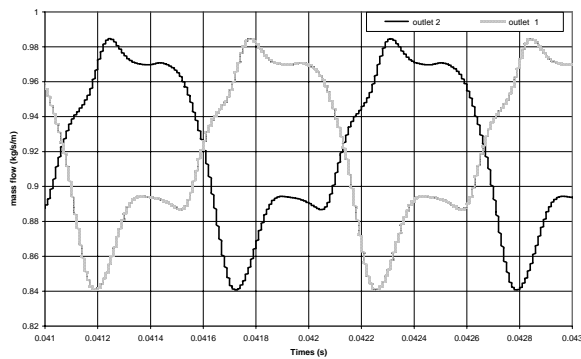


Fig.5. Mass flow output.

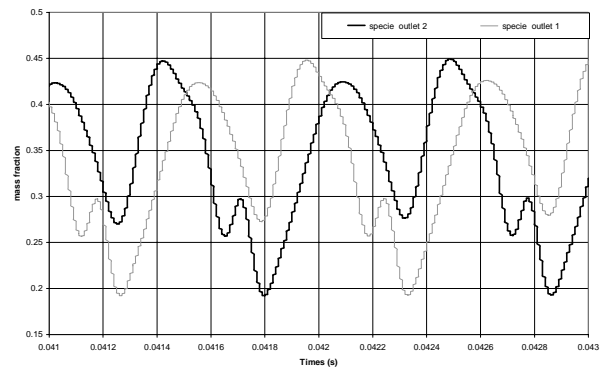


Fig.6. Species mass fraction output.

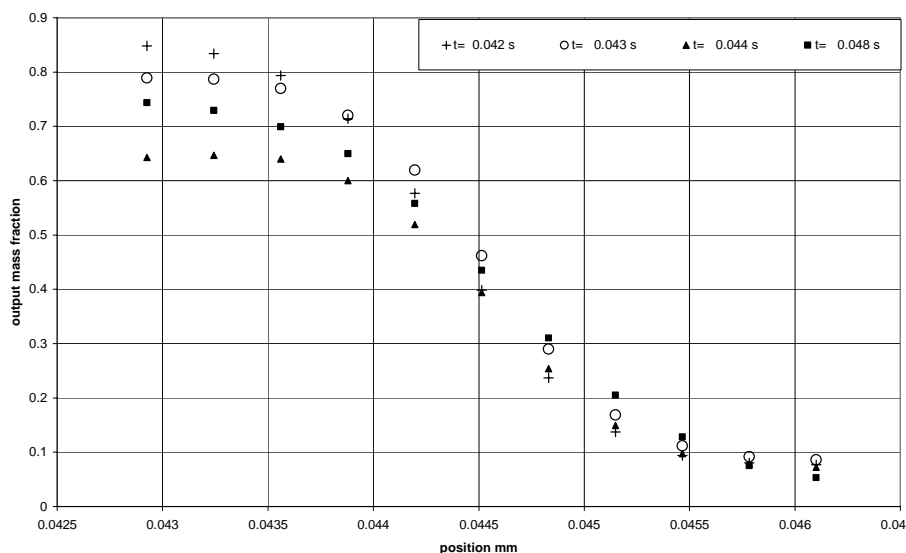


Fig.7. Output mass fraction at four times.

5. Conclusions

The performance of oscillating mixer with millimetric size was simulated using Fluent Code. The first results of these numerical calculations indicate evaluation oscillating frequency of fluidic oscillator, the next one consist of mixing estimation. In this study we show complex geometry based of oscillator unit. The oscillator produces auto-perturbations through the mixed flow. The frequency results, produced by auto-pulsed perturbations preserve mass fraction between 0.2 and 0.45 figure 6, but in output device de mass fraction oscillate between 0.4 and 0.5 in middle position figure 7 In perspective we propose experimental study for estimate mixing efficiency with three configurations mixer. And propose this device for gaseous flow control.

References

- [1] P. Tabeling, Introduction à la micro fluidique, *Collection Echelles*, Belin, 2003.
- [2] Volker Hessel, Holger Löwe, Friedhelm Schönfeld, Micromixer-a review on passive and active mixing principles, *Chemical Engineering Science*, 60, 2005, pp. 2479-2501.
- [3] A. Bertsch, S. Heimgartner, P. Cousseau and P. Tenaud, Static micromixers based on large scale industrial mixer geometry, *LAB on a Chip*, 2001, 1, pp. 56-60.
- [3] Arash Dodge, Marie-Caroline Julien, Yi-Kuen Lee, X.Niu, Fridolin Okkels, Patrick Tabeling, An example of a chaotic micromixer: the cross-channel micromixer, *C.R. Physique*, 5, 2004, pp. 557-563.
- [4] U. Gebhard, H. Hein and U. Schmidt, Numerical investigation of fluidic micro-oscillators, *J. Micromech, Microeng.*, 6, 1996, pp. 115-117.
- [5] V. Tesar, J. R. Tippetts, Y. Y. Low, Oscillator mixer for chemical microreactors, *9th International Symposium on Flow Visualisation*, 2000, pp. 298.1-298.7.
- [6] K. Foster, C. A. Parker, *Fluidic Components & Circuits*, John Wiley & Soon Ltd, 1970, ISBN 0471267708, pp. 265-273.
- [7] W. Gerhard, Fluidic temperature sensor investigation for high gas temperatures, 1969, AGARDograph 135.
- [8] Eliphaz Wagner Simões, Rogerio Furlan, Roerto Eduardo Bruzetti Leminski, Numerical Oscillator For gas flow control and measurement, *J. Flow Measurement and Instrumentation*, 16, 2005, pp. 7-12.

Guide for Contributors

Aims and Scope

Sensors & Transducers Journal (ISSN 1726- 5479) provides an advanced forum for the science and technology of physical, chemical sensors and biosensors. It publishes state-of-the-art reviews, regular research and application specific papers, short notes, letters to Editor and sensors related books reviews as well as academic, practical and commercial information of interest to its readership. Because it is an open access, peer review international journal, papers rapidly published in *Sensors & Transducers Journal* will receive a very high publicity. The journal is published monthly as twelve issues per annual by International Frequency Association (IFSA). In addition, some special sponsored and conference issues published annually.

Topics Covered

Contributions are invited on all aspects of research, development and application of the science and technology of sensors, transducers and sensor instrumentations. Topics include, but are not restricted to:

- Physical, chemical and biosensors;
- Digital, frequency, period, duty-cycle, time interval, PWM, pulse number output sensors and transducers;
- Theory, principles, effects, design, standardization and modeling;
- Smart sensors and systems;
- Sensor instrumentation;
- Virtual instruments;
- Sensors interfaces, buses and networks;
- Signal processing;
- Frequency (period, duty-cycle)-to-digital converters, ADC;
- Technologies and materials;
- Nanosensors;
- Microsystems;
- Applications.

Submission of papers

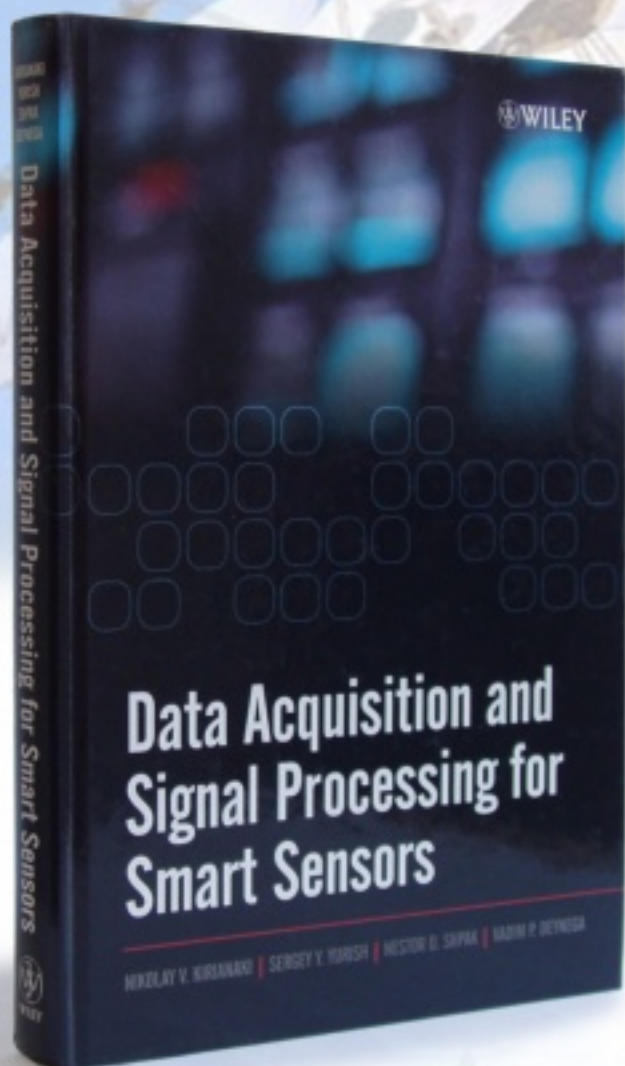
Articles should be written in English. Authors are invited to submit by e-mail editor@sensorsportal.com 4-12 pages article (including abstract, illustrations (color or grayscale), photos and references) in both: MS Word (doc) and Acrobat (pdf) formats. Detailed preparation instructions, paper example and template of manuscript are available from the journal's webpage: <http://www.sensorsportal.com/HTML/DIGEST/Submission.htm> Authors must follow the instructions strictly when submitting their manuscripts.

Advertising Information

Advertising orders and enquires may be sent to sales@sensorsportal.com Please download also our media kit: http://www.sensorsportal.com/DOWNLOADS/Media_Kit_2007.PDF



KNOWLEDGE FOR GENERATIONS



'This book provides a good basis for anyone entering or studying the field of smart sensors not only for the inexperienced but also very useful to those with some experience'

(from IEEE Instrumentation & Measurement Magazine review)



Order online:

http://www.sensorsportal.com/HTML/BOOKSTORE/DAQ_SP.htm

www.sensorsportal.com