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Geometric effects on mixing performance in a novel passive micromixer with trapezoidal-zigzag channels - DTU Orbit (08/11/2017)

Geometric effects on mixing performance in a novel passive micromixer with trapezoidal-zigzag channels

A novel passive micromixer, called a trapezoidal-zigzag micromixer (TZM), is reported. A TZM is composed of trapezoidal channels in a zigzag and split-recombine arrangement that enables multiple mixing mechanisms, including splitting-recombining, twisting, transversal flows, vortices, and chaotic advection. The effects of geometric parameters of the TZM on mixing performance are systematically investigated by the Taguchi method and numerical simulations in COMSOL Multiphysics. The number of mixing units, the slope angle of the trapezoidal channel, the height of the constriction element, and the width ratio between the middle-trapezoidal channel and the side-trapezoidal channel are the four parameters under study. The mixing performance of the TZM is investigated at three different Reynolds number (Re) values of 0.5, 5, and 50. The results showed that a TZM with six mixing units, a trapezoidal slope angle of 75°, a constricting height of 100 m, and a width ratio of 0.5 has the highest mixing efficiency. This optimal TZM has a mixing efficiency greater than 85% for Re values from 0.1 to 80. In particular, for Re 0.9 and Re 20, the mixing efficiency of the optimal TZM is greater than 90%. The proposed TZM has a higher mixing efficiency and a smaller footprint than previously reported micromixers.

General information

State: Published
Organisations: DTU Danchip, Ton Duc Thang University, Buskerud and Vestfold University College
Authors: The, H. L. (Ekstern), Ta, B. Q. (Ekstern), Lê Thanh, H. (Intern), Dong, T. (Ekstern), Thoi, T. N. (Ekstern), Karlsen, F. (Ekstern)
Number of pages: 11
Publication date: 2015
Main Research Area: Technical/natural sciences

Publication information

Journal: Journal of Micromechanics and Microengineering
Volume: 25
Issue number: 9
Article number: 094004
ISSN (Print): 0960-1317
Ratings:
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.74 SJR 0.595 SNIP 1.017
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.64 SNIP 1.211 CiteScore 1.96
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.725 SNIP 1.224 CiteScore 1.84
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.611 SNIP 1.055 CiteScore 1.74
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.856 SNIP 1.402 CiteScore 1.92
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.038 SNIP 1.437 CiteScore 2.43
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.019 SNIP 1.634
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1

Scopus rating (2009): SJR 1.17 SNIP 1.517
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 1.27 SNIP 1.634
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 1.437 SNIP 1.837
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 1.341 SNIP 2.118
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 1.28 SNIP 2.116
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 1.122 SNIP 1.933
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 1.457 SNIP 1.642
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 0.983 SNIP 1.439
Web of Science (2002): Indexed yes
Scopus rating (2001): SJR 0.765 SNIP 1.707
Web of Science (2001): Indexed yes
Scopus rating (2000): SJR 0.618 SNIP 1.004
Scopus rating (1999): SJR 0.986 SNIP 1.076
Original language: English
Effective passive micromixer, High mixing efficiency, Trapezoidal-zigzag channels
DOIs:
10.1088/0960-1317/25/9/094004
Source: FindIt
Source-ID: 2280724504
Publication: Research - peer-review › Journal article – Annual report year: 2015