Microfluidos

Gerardo Callegari & German Drazer
Departamento de Ingeniería Mecánica y Aeroespacial
Rutgers, La Universidad de Nueva Jersey

Contenidos del Curso

Martes:

0. Introducción al curso.
1. Introducción.
2. Física a escala microscópica

Miercoles:

3. Hidrodinámica a escala microscópica
4. Transporte y régimen de Stokes en microfluidica.

Jueves:

5. Difusión Molecular y Transporte de Masa
6. Dispersión y mezclado en microfluidica

Viernes:

7. Electrocinética
8. Aplicaciones: Separación de partículas suspendidas

Lunes:

9. Métodos de fabricación

Formato y Evaluación

15 hs Contenidos teóricos (martes 15 a viernes 18 de 10 a 13 y viernes 18 de 14 a 17).

9 hs Prácticas de Laboratorio (martes 22 al jueves 24, de 10 a 13)

Los profesores mostrarán el funcionamiento de algunos dispositivos. Además enseñarán las técnicas de fabricación, paso por paso. Los alumnos dispondrán de material y aprenderán las técnicas para elaborar y testear sus propios dispositivos.

4hs Seminario (exposición de alumnos, lunes 21, 14-18hs)

Los alumnos elegirán una publicación de una lista dada por los profesores y expondrán sus ideas principales en 25 minutos con 5 minutos para preguntas.

2 1/2hs Evaluación contenidos teóricos (martes 10-12:30)

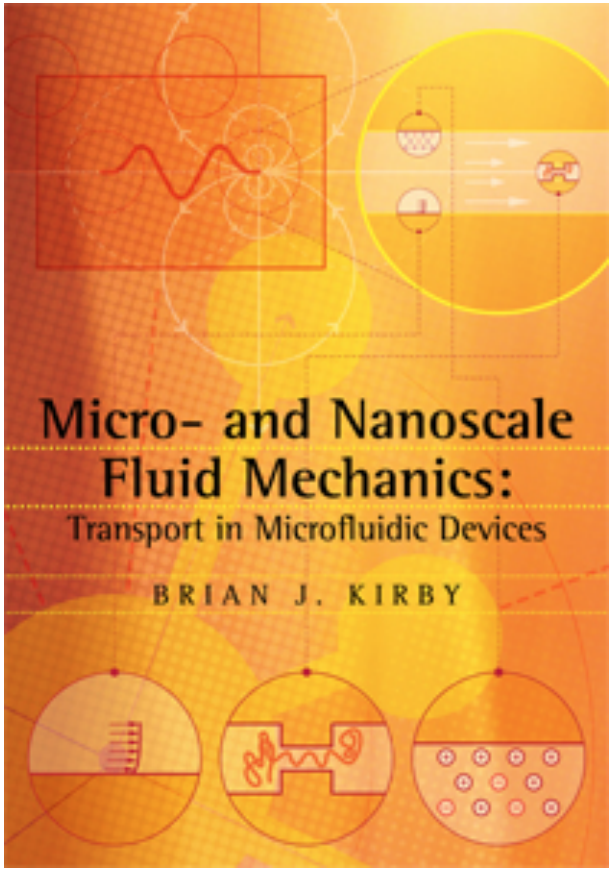
3 1/2hs Evaluación Laboratorio: (martes 29, 13:30-17)

Los alumnos habrán ensamblado su propio dispositivo, lo conectarán y demostrarán.

Breve repaso de la literatura y material disponible impreso, electrónico, online…

Libro disponible online

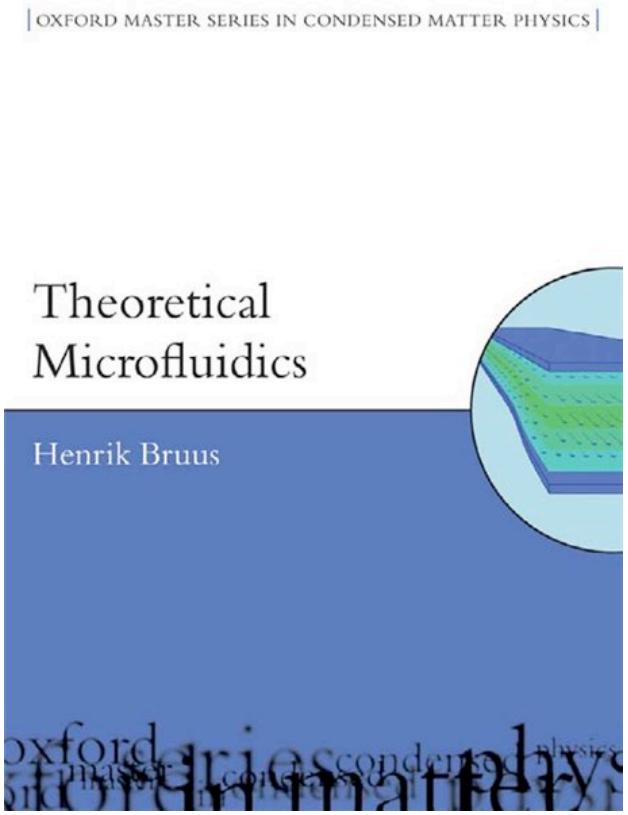
Prof. Brian J. Kirby
Departamento de Ingeniería Mecánica de Cornell

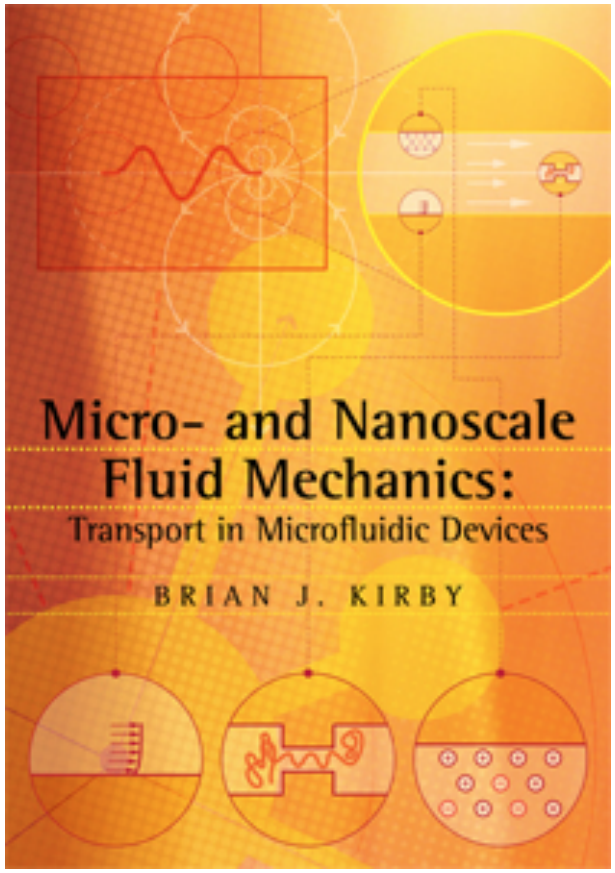


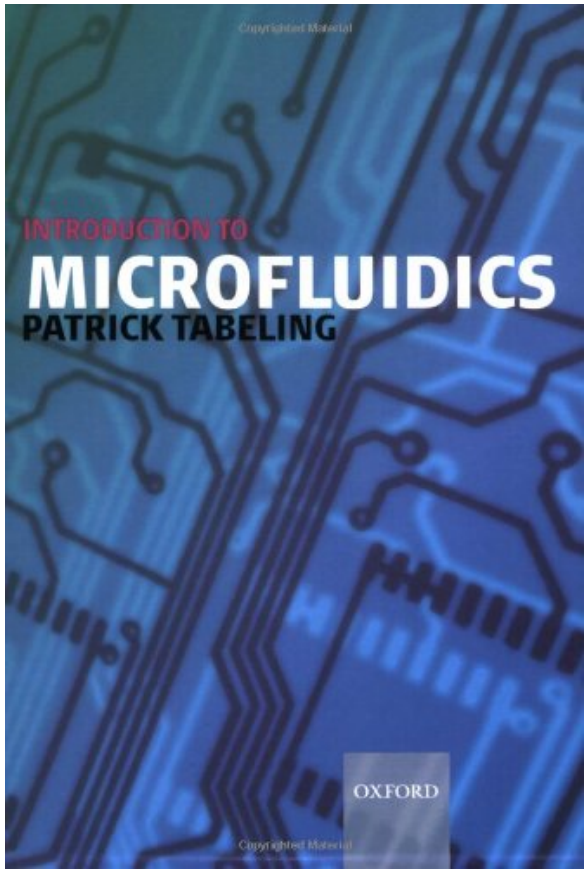
http://www.kirbyresearch.com/index.cfm/wrap/textbook/microfluidicsnanofluidics.html

Incluye clases en youtube!

Libros (impresos y pdfs)

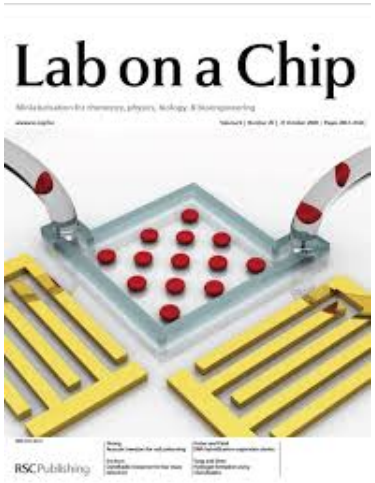


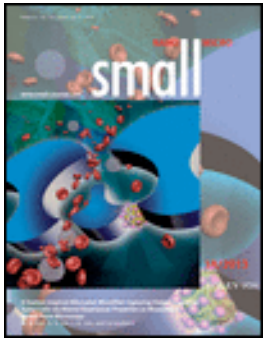


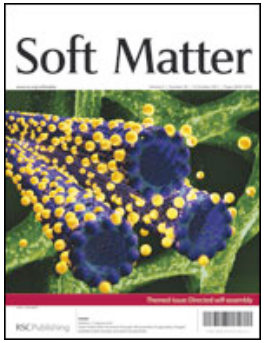


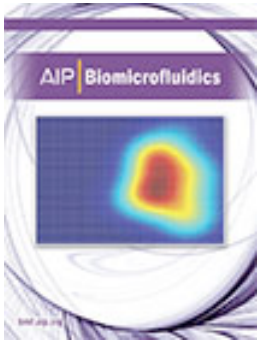
Clases también en pdf

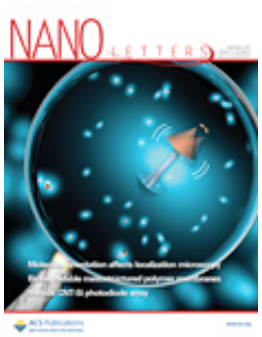
Algunas revistas interesantes

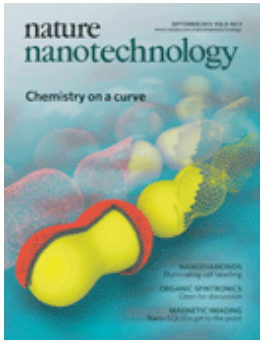












Otros recursos online

Welcome to Chips & Tips!

27 Apr 2011

By Francesca Burgoyne.

Welcome to **Chips & Tips** – a unique and regularly updated forum for scientists in the miniaturisation field from *Lab on a Chip*. Chips & Tips aims to provide a place where ideas and solutions can be exchanged on common practical problems encountered in the lab, which are seldom reported in the literature.

Do you

- have problems with bubble formation when injecting your sample?
- wish there was a quicker way to make prototypes?
- find connecting chips to pumps and syringes problematic?

Or

- do you have your own tricks to overcome these or similar problems?

If so, then Chips & Tips is the forum to address your requirements! Read the Tips below or see the author guidelines on how to submit your own today.

Chips & Tips is moderated by **Glenn Walker** (North Carolina State University).

Please note Chips and Tips published before April 2011 were originally published at www.rsc.org.

Add a Comment »

Foro online donde discuten aspectos experimentales en microfabricación

http://blogs.rsc.org/chipsandtips/

Guías, videos, classes…

Prof. Yager, Universidad de Washington
http://faculty.washington.edu/yagerp/microfluidicstutorial/tutorialhome.htm

Prof. Wereley, Purdue
https://engineering.purdue.edu/~wereley/fundamentalsofmicrofluidics_files/v3_document.htm

Prof. Whitesides, Harvard
http://gmwgroup.harvard.edu/index.php

Prof. Weitz, Harvard
http://weitzlab.seas.harvard.edu/

Prof. Craighead, Cornell
http://www.hgc.cornell.edu/

Prof. Santiago, Stanford
http://microfluidics.stanford.edu/

Videos @ Duke
http://microfluidics.ee.duke.edu//

Microfluidos: Perspectivas

INSIGHT OVERVIEW NATURE|Vol 442|27 July 2006|doi:10.1038/nature05058

The origins and the future of microfluidics

George M. Whitesides[1]

The manipulation of fluids in channels with dimensions of tens of micrometres — microfluidics — has emerged as a distinct new field. Microfluidics has the potential to influence subject areas from chemical synthesis and biological analysis to optics and information technology. But the field is still at an early stage of development. Even as the basic science and technological demonstrations develop, other problems must be addressed: choosing and focusing on initial applications, and developing strategies to complete the cycle of development, including commercialization. The solutions to these problems will require imagination and ingenuity.

G. M. Whitesides:
- Pionero en microfluidos
- Introdujo la idea de fabricación en PDMS

Perspectivas

Perspective

Microfluidics: Basic Issues, Applications, and Challenges

H. A. Stone
Div. of Engineering and Applied Sciences, Harvard University, Cambridge, MA 02138

S. Kim
Lilly Research Laboratories, Lilly Corporate Center, Indianapolis, IN 46285

1250 June 2001 Vol. 47, No. 6 AIChE Journal

H. A. Stone:
- Mecánica de fluidos
- Muchas contribuciones en temas variados

S. Kim:
- Mecánica de fluidos. Libro: *Microhydrodynamics*

Microfluidos/Lab on a chip: Reviews

Annu. Rev. Fluid Mech. 2004. 36:381–411
doi: 10.1146/annurev.fluid.36.050802.122124

ENGINEERING FLOWS IN SMALL DEVICES: Microfluidics Toward a Lab-on-a-Chip

H.A. Stone,[1] A.D. Stroock,[2] and A. Ajdari[3]
[1]*Division of Engineering and Applied Sciences, Harvard University, Cambridge, Massachusetts 02138; email: has@deas.harvard.edu*
[2]*School of Chemical and Biomolecular Engineering, Cornell University, Ithaca, New York 14853; email: ads10@cornell.edu*
[3]*Physico-Chimie Théorique, UMR CNRS-ESPCI 7083, ESPCI, 10 rue Vauquelin, 75005 Paris, France; email: armand@turner.pct.espci.fr*

Visión mas aplicada/ingeniería

Reviews

REVIEWS OF MODERN PHYSICS, VOLUME 77, JULY 2005

Microfluidics: Fluid physics at the nanoliter scale

Todd M. Squires*

Departments of Physics and Applied & Computational Mathematics, California Institute of Technology, Pasadena, California 91125, USA

Stephen R. Quake†

Departments of Applied Physics and Physics, California Institute of Technology, Pasadena, California 91125, USA

(Published 6 October 2005)

Microfabricated integrated circuits revolutionized computation by vastly reducing the space, labor, and time required for calculations. Microfluidic systems hold similar promise for the large-scale automation of chemistry and biology, suggesting the possibility of numerous experiments performed rapidly and in parallel, while consuming little reagent. While it is too early to tell whether such a vision will be realized, significant progress has been achieved, and various applications of significant scientific and practical interest have been developed. Here a review of the physics of small volumes (nanoliters) of fluids is presented, as parametrized by a series of dimensionless numbers expressing the relative importance of various physical phenomena. Specifically, this review explores the Reynolds number Re, addressing inertial effects; the Péclet number Pe, which concerns convective and diffusive transport; the capillary number Ca expressing the importance of interfacial tension; the Deborah, Weissenberg, and elasticity numbers De, Wi, and El, describing elastic effects due to deformable microstructural elements like polymers; the Grashof and Rayleigh numbers Gr and Ra, describing density-driven flows; and the Knudsen number, describing the importance of noncontinuum molecular effects. Furthermore, the long-range nature of viscous flows and the small device dimensions inherent in microfluidics mean that the influence of boundaries is typically significant. A variety of strategies have been developed to manipulate fluids by exploiting boundary effects; among these are electrokinetic effects, acoustic streaming, and fluid-structure interactions. The goal is to describe the physics behind the rich variety of fluid phenomena occurring on the nanoliter scale using simple scaling arguments, with the hopes of developing an intuitive sense for this occasionally counterintuitive world.

Intenta ser una visión mas física

IOP Publishing Reports on Progress in Physics
Rep. Prog. Phys. **75** (2012) 016601 (41pp) doi:10.1088/0034-4885/75/1/016601

Droplet based microfluidics

Ralf Seemann[1,2], Martin Brinkmann[2], Thomas Pfohl[2,3] and Stephan Herminghaus[2]

[1] Experimental Physics, Saarland University, D-66123 Saarbrücken, Germany
[2] Max Planck Institute for Dynamics and Self-Organization, D-37018 Göttingen, Germany
[3] Department of Chemistry, University of Basel, CH-4056 Basel, Switzerland

E-mail: ralf.seemann@physik.uni-saarland.de

Received 1 November 2010, in final form 22 September 2011
Published 22 December 2011
Online at stacks.iop.org/RoPP/75/016601

Abstract
Droplet based microfluidics is a rapidly growing interdisciplinary field of research combining soft matter physics, biochemistry and microsystems engineering. Its applications range from fast analytical systems or the synthesis of advanced materials to protein crystallization and biological assays for living cells. Precise control of droplet volumes and reliable manipulation of individual droplets such as coalescence, mixing of their contents, and sorting in combination with fast analysis tools allow us to perform chemical reactions inside the droplets under defined conditions. In this paper, we will review available drop generation and manipulation techniques. The main focus of this review is not to be comprehensive and explain all techniques in great detail but to identify and shed light on similarities and underlying physical principles. Since geometry and wetting properties of the microfluidic channels are crucial factors for droplet generation, we also briefly describe typical device fabrication methods in droplet based microfluidics. Examples of applications and reaction schemes which rely on the discussed manipulation techniques are also presented, such as the fabrication of special materials and biophysical experiments.

(Some figures may appear in colour only in the online journal)

This article was invited by C F Schmidt.