



MICROFLUIDICS AND BIOCHIP DESIGN ANALYSIS

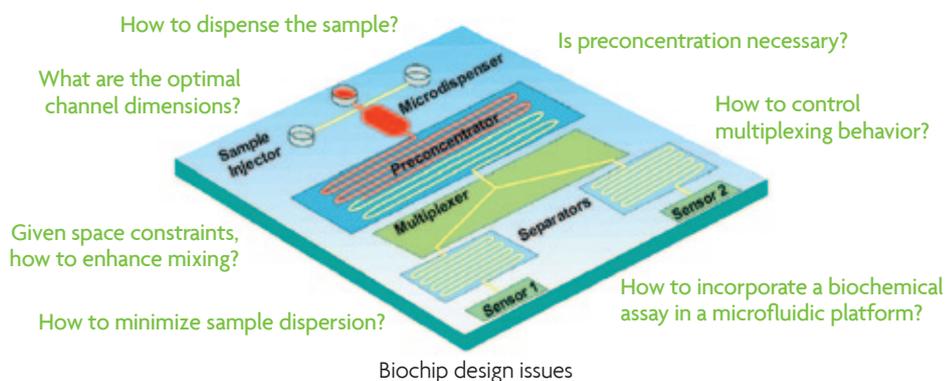
WITH ACE+ SUITE

KEY BENEFITS

- Accelerate your product development with rapid screening of concepts and design optimization.
- Accurately analyze MEMS and microfluidics devices both at high-fidelity level and mixed-dimensionality mode.
- Speedily generate grids using process files.
- Perform several design iterations without costly and time-consuming device fabrication at each change.
- Benefit from a true multiphysics platform with seamless coupling between flow, heat, chemistry, electromagnetics, rarefied flow module as well as structural analysis.

As the bio world is moving towards miniaturization, microfluidics-based biochips are expected to revolutionize clinical diagnosis, DNA sequencing and other bioscience applications. As microfluidics applications evolve, design complexity and engineering challenges such as optimized processes in mixing, reaction, separation, pre-concentration and detection of chemical species are expected to increase dramatically.

To overcome the design challenges, leading edge microfluidic, lab-on-chip, biodiagnostic and biosensor companies use ACE+ Suite to analyze, design and optimize their devices for best performance, reduced engineering cost, and faster time to market.

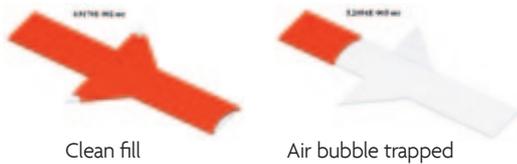


ACE+ Suite analyzes and optimizes multiple, complex, interacting physicochemical phenomena occurring within the biotech/microfluidic applications.

Non-exhaustive list of capabilities and features

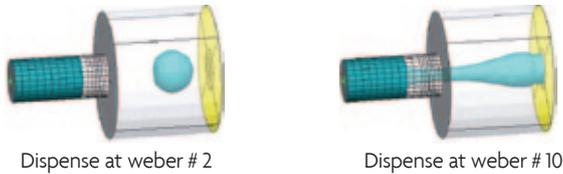
MICROFLUIDICS	BIOCHEMISTRY	ELECTROKINETICS/CHEMISTRY
<ul style="list-style-type: none"> · Hydrophobic/hydrophilic filling and dispensing · Pressure driven flow · Taylor-Aris dispersion · Sample mixing · Particle/cell transport · Fluid Structure Interaction (FSI) · Heat transfer (PCR cycling) 	<ul style="list-style-type: none"> · Mass transport or kinetics-limited binding · Antigen-antibody, ligand-receptor binding · Multi-protein, multi-receptor, competitive binding · DNA hybridization · Surface or volume-immobilized enzyme catalysis (Michaelis-Menten) · Microsphere-based detection (immunoassays) 	<ul style="list-style-type: none"> · Electroosmosis/electrophoresis · Ionization involving acid/base reactions, ampholyte chemistry · Electrokinetic injection, joule heating · Field amplified sample stacking · Electrochemical sensing, conventional & traveling wave dielectrophoresis · Sample dispersion under EOF · Electromagnetics and AC/DC electric fields · Modes of focusing/separation - isoelectric focusing, isotachopheresis, pH gradient electrophoresis, CE-ITP, etc.

MICROFLUIDICS FILLING



- Liquid filling in micro channel
- Surface properties determine the void/bubble formation in capillary filling

LIQUID DISPENSING



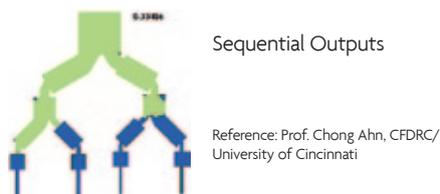
- Nanoliter liquid dispensing
- Simulation using fluid-structure interaction
- Ejection speed & surface and liquid properties control droplet formation
- Droplet size can be determined accurately

SEPARATION OF CELLS (DEP)



- Separation of cells/particles based on size and electrical properties
- Simulation using traveling wave dielectrophoresis
- Cells separated and transported under AC electric field

MICROFLUIDICS PASSIVE VALVES



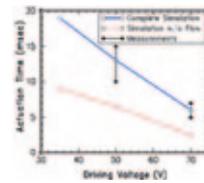
- Passive valves based on balance of surface and pressure forces
- Coupled 3D flow-surface tracking simulation
- Optimize multiplexer/filling processes

STATIC MICROMIXER

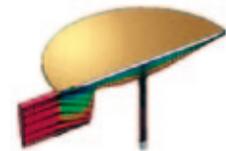


- Mixing of analytes based on diffusion
- Coupled 3D flow-analyte transport simulations
- Minimize mixing time via geometry and improved residence time

ACTIVE PUMPING: DIAPHRAGM



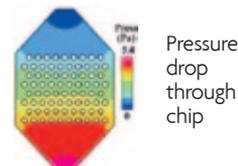
— complete simulation;
- - - without flow



Coupled electrostatic-structures-fluid simulation of a BEAD Mesopump

- Bi-directional electrostatically activated diaphragm (BEAD) pump
- Coupled 3D flow-structures-electrostatics simulation
- Optimize pump using designs, materials and fields

OPTIMIZATION OF DNA CAPTURE CHIP



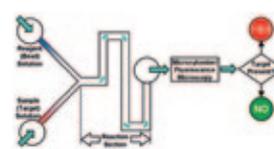
Pressure drop through chip



Flow fields around pillars

- Determine component valve for best design
- Auto-simulation using simulation manager
- Optimize device performance

MICROSPHERE BASED ASSAY



Microsphere-based Immunoassay Sensor

- Antigen in buffer solution is binding to antibody coated in beads
- Simulation using particle transport, flow and biochemistry capabilities
- Quality of assay speed/sensitivity as a function of bead size/flow

ABOUT
ESI GROUP



ESI is a pioneer and world-leading provider in virtual prototyping for manufacturing industries that takes into account the physics of materials. ESI has developed an extensive suite of coherent, industry-oriented applications to realistically simulate a product's behavior during testing, to fine-tune manufacturing processes in accordance with desired product performance, and to evaluate the environment's impact on performance. ESI's solutions fit into a single collaborative and open environment for End-to-End Virtual Prototyping, thus eliminating the need for physical prototypes during product development. The company employs about 850 high-level specialists worldwide covering more than 30 countries. ESI Group is listed in compartment C of NYSE Euronext Paris. For further information, visit www.esi-group.com.

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