

## **Ebraheem Fontaine**

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### **EDUCATION**

#### **California Institute of Technology**

Ph.D. in Mechanical Engineering

**March 2008 (expected)**

Thesis: Automated Tracking for Behavior Analysis of Biological Model Organisms

M.S. in Mechanical Engineering

**June 2004**

#### **Massachusetts Institute of Technology**

B.S. in Mechanical Engineering

**June 2002**

Thesis: A Laboratory Demonstration of a Parallel Robotic Mechanism with Integrated EPAM Actuators

Minor: Public Policy

### **RESEARCH EXPERIENCE**

#### **California Institute of Technology**

*Research Assistant*

**September 2002 - Present**

Advisor: Dr. Joel W. Burdick

- Developed image processing and tracking algorithms to estimate the detailed body posture of biological organisms engaged in important behavior modes within laboratory environments
- Designed detailed geometric models with finite parameterizations that are estimated using sequential Bayesian Inference
- Currently, estimating the 3D body and wing kinematics of fruit flies during flight initiation to understand the neuronal mechanisms of insect flight in collaboration with the laboratory of Dr. Michael Dickinson
- Applied methods to analyzing the mating behavior of the *C. elegans* nematode to help understand the modulation of locomotory behavior by sensory input in collaboration with the laboratory of Dr. Paul Sternberg
- Tracked and analyzed larval and adult zebrafish to measure the influence of vertebra development on swimming capabilities in collaboration with the Experimental Zoology Group at Wageningen University
- Performed experimental fluid visualization of black ghost knifefish using particle image velocimetry
- Designed and constructed a biomimetic robotic device based on the morphology of the black ghost knifefish which achieves near omnidirectional swimming from a peculiar undulating ventral fin

#### **Massachusetts Institute of Technology**

*Research Assistant*

**February 2001 – June 2002**

Advisor: Dr. Steven Dubowsky

- Performed rapid prototyping of various compliant mechanism designs using abrasive waterjet cutting
- Assisted in the design and fabrication of electrostrictive polymer artificial muscles (EPAM)
- Developed experimental demonstrations of binary robotic devices that incorporated EPAM and electromagnetic actuators

## TEACHING EXPERIENCE

*Seminar XL Facilitator*

**September 2000 – June 2002**

- Instructed a group of 3-7 MIT freshman in mechanics and electromagnetism for 3 hours per week
- Prepared several example problems for each tutorial session that consisted of significant student interaction
- Session was designed to stimulate in depth learning for students needing help beyond the material presented in lecture and recitation

*NASA RISE Summer Instructor*

**June 2001 – August 2001**

- Instructed students in technical writing and oral presentation skills as part of an 8 week engineering research program
- Designed quantitative evaluation sheets to provide students feedback at bi-weekly presentation sessions

## PROFESSIONAL EXPERIENCE

**Institute for Defense Analyses, Alexandria, VA**

**June 2000 – August 2000**

*Summer Intern*

- Performed extensive study of the Comprehensive Nuclear Test Ban Treaty and nuclear weapon design and manufacturing
- Assisted in preparing a report delivered to the Office of Secretary of Defense describing the capability of nuclear weapon development in foreign states under the treaty conditions
- Trained users on the Synthetic Environments for National Security Estimates (S.E.N.S.E) project, a distributed desktop virtual environment capable of simulating global economic, political, social, and military issues simultaneously

**Xerox Corporation, Webster, NY**

**June 1999 – August 1999**

*Summer Intern*

- Developed and archived training modules that described the electronic layout and diagnostic procedure of several company products
- Assisted in delivering training sessions to the industrial workforce

## PUBLICATIONS

**Fontaine, E.,** Lentink, D., Kranenbarg, S., Müller, U., van Leeuwen, J., Barr, A.H., & Burdick, J.W. "Automated visual tracking for studying the ontogeny of zebrafish swimming." *submitted*, 2007

**Fontaine, E.,** Barr, A.H., & Burdick, J.W. "Tracking multiple worms and fish for biological studies." *ICCV Workshop on Dynamical Vision*, 2007.

**Fontaine, E.,** Barr, A.H., & Burdick, J.W. "Automated tracking of multiple c. elegans." *IEEE International Conference of the Engineering in Medicine and Biology Society*, 2006.

MacIver, M.A., **Fontaine, E.,** & Burdick, J.W. "Designing future underwater vehicles: principles and mechanisms of the weakly electric fish." *IEEE Journal of Oceanic Engineering*, 29(3): 651-659, 2004.

## CONFERENCE ABSTRACTS

**Fontaine, E.,** Whittaker, A.J., Sternberg, P.W., Barr, A.H., & Burdick, J.W. "Semi Automated tools for analyzing C. elegans male mating." *16<sup>th</sup> International C. elegans Meeting*, 2007.

**Fontaine, E.,** Lentink, D., Leeuwen, J.L. van, Barr, A.H., & Burdick, J.W. "Automated visual tracking for the analysis of zebrafish swimming." *International Congress of Neuroethology*, 2007.

**LEADERSHIP & MENTORING***Resident Associate***July 2004 – July 2007**

- Lived in the undergraduate housing system at California Institute of Technology and served as a liaison between students and the Office of Institute Housing
- Interacted with students on a regular basis and performed crisis intervention, short term counseling, and assistance in seeking out campus resources
- Organized social and educational programming activities and facilitated faculty and staff involvement in the residence

*Yaseen Educational Foundation***December 2003 – June 2006**

- Served as a teacher and administrator for a weekend school with 15-25 students between the ages of six and 16. School met for three hours per week.
- Developed daily schedule, school calendar, registration forms, and attendance records
- Discussed and resolved curriculum content, evaluation procedures, and behavioral issues with teachers
- Gathered and incorporated feedback from parents
- Organized periodic social activities for the students

*Blair High School***September 2003 – March 2003**

- Served as a tutor in an after-school program for junior high school students
- Tutored all subjects, especially math

*Big Brother Program of Massachusetts Bay***January 2000 – June 2002**

- Served as a mentor for a thirteen year old resident of Dorchester, MA
- Fostered a close relationship with individual through frequent social and educational activities

**AWARDS & HONORS**

James Irvine Foundation Graduate Fellowship	<b>2002</b>
GEM Fellowship (declined)	<b>2002</b>
Ronald E. McNair Scholarship Award	<b>2002</b>
Albert G. Hill Prize	<b>2001</b>
NASA / DCES Undergraduate Scholarship	<b>2001</b>
NASA Space Grant Undergraduate Scholarship	<b>2000</b>

**PROFESSIONAL MEMBERSHIPS**

Institute of Electrical and Electronic Engineers (IEEE)  
 American Society of Mechanical Engineers (ASME)  
 Society of Industrial and Applied Mathematics (SIAM)