

Jean-Baptiste Mathieu

NANOROBOTICS LABORATORY:

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OBJECTIVE: Industrial Scholarship and Post Doctoral Fellowship.

SUMMARY:

- **Ph.D. Student and Team Leader in Nanorobotics research project**

- MRI Propulsion, Tracking & Drug Delivery
- Mechanical & Biomedical Engineering
- Microfabrication
- Biocompatibility
- Aeronautical design and fabrication

LANGUAGES: English, French, German, Spanish

EDUCATION: **M.Sc. Biomedical Engineering; graduation Sep 2004.**

Nanorobotics laboratory,
Ecole Polytechnique de Montreal (EPM) GPA 3.54 on a 4.0 scale

B. Eng. Mechanical Engineering; May 2002.

Mechatronics specialization,
Ecole Polytechnique de Montreal (EPM) GPA 3.25 on a 4.0 scale

SAT; Math 610, Verbal 660; December 1996
TOEFL; 290

Courses taken included:

Electromagnetism	Microsystems – MEMS
Medical Imaging	Mechanical Stress Analysis
Drug Targeting	Control Theory
Colloid Chemistry	Microfabrication
Composite Materials	Fluid dynamics
Biocompatibility	Heat Transfer

EXPERIENCE: **Nanorobotics laboratory, Jan 2002 to Current, EPM,**

- Fundamental work and proof of concept in MRI / Nanorobotics research project
- Gradient coils design
- Key contribution in grant proposals (NSERC \$ 130 000 per year , CFI \$ 4 000 000)
- Mechanical and Electromagnetics design
- Leadership in multidisciplinary research team (physics, biocompatibility, electrical and computer engineering, radiology).
- CNC machining: EDM, turning, milling.
- Technical writing
- 30% innovation rights in two US Patent application

ACTIVITIES:

2005 Voluntary supervision in Leucan cancer in children summer camp

2003-2004 President, Condominium complex association

2002-2003 Secretary, Condominium complex association

1998-2002 Student Aerodesign Team (SAE aerodesign competition)

- Designed and built 5 weight lifting airplanes (world first place award in 2000 and 2002)
- Hands on Experience in aerospace mechanics, aeronautics design and fabrication techniques
- Team work, project management
- Communication director: Technical reports, sponsoring activities, promotional events, TV interviews
- CAD/CAM
- Composite materials design and fabrication

2000-2003 Student recruitment (Ecole Polytechnique Montreal)

- Guided tours, animation in promotional events, telemarketing

COMPUTER SKILLS:

- Matlab, FemLab, Maple, Simulink
- Autocad, Dassault Catia v4, v5 (CAD), Photoshop, 3DS Max, Rhino 3D
- Nastran (FEA), ANSYS (FEA), PC Laminate (composite materials Design)
- C++

ADDITIONAL FORMATION:

- NC Machining: Milling and Turning training at EMCO-MAIER facilities, Columbus Ohio
- Public speaking: One term course, Continuing Education, McGill University, (Montreal Canada)
- Microfabrication: Clean Room Environment, EDM, Photolithography, Excimer laser

PRIZES AND AWARDS:

- 2005-2006 GRSTB Scholarship (Biomedical Science and Technology Research Group)
- 2006-Current FQRNT Scholarship (Quebec Fund for Research on Nature and Technology)
- ISMRM conference 2006: 3rd place in Intervention MRI poster competition

PUBLICATIONS:

Journal Papers :

- MARTEL, S., **MATHIEU, J.B.**, FELFOUL, O., CHANU, O., ABOUSSOUAN, E., TAMAZ, S., POUPONNEAU, P., BEAUDOIN, G., SOULEZ, G., YAHIA, L'H., MANKIEWICZ, M., "Automatic Vascular Navigation of Untethered Objects Using Magnetic Resonance Imaging Technology", Applied Physics Letters, vol. 90, 10, Mar 5th 2007.
- FELFOUL, O., **MATHIEU, J.B.**, BEAUDOIN, G., MARTEL, S., MR-tracking Based on Magnetic Signature Selective Excitation, IEEE Trans. Med. Imaging, (2006), (Accepted, 2007-02-04)
- **MATHIEU, J.B.**, MARTEL, S., "Magnetic Microparticle Steering within the Constraints of an MRI System: Proof of concept of a Novel Targeting Approach", Biomedical Microdevices, (2006), (In Review)
- TAMAZ S., CHANU A., **MATHIEU J.B.**, GOURDEAU R., MARTEL S., Real-time MRI-based Control of a Ferromagnetic Core for Endovascular Navigation, IEEE Transactions on Biomedical Engineering, (2006), (In Review)
- **MATHIEU, J.B.**, BEAUDOIN, G., MARTEL, S. "Method of propulsion of a ferromagnetic core in the cardiovascular system through magnetic gradients generated by an MRI system". IEEE Transactions on Biomedical Engineering, Vol.53, no. 2., (2006), p292-299
- **MATHIEU, J.B.**, MARTEL, S., YAHIA, L., SOULEZ, G., BEAUDOIN, G. "Preliminary Investigation of the Feasibility of Magnetic Propulsion for Future Microdevices in Blood Vessels". BioMedical Materials and Engineering, vol. 15 (2005), pp. 367-374

Patents :

- MARTEL S., **MATHIEU J.B.**, YAHIA L'H., SOULEZ G., BEAUDOIN G., 2004, "Method and System for Propelling and Controlling displacement of a Microrobot in a blood Vessel", US 2004/0210128A1, CA2425795-A1.
- **MATHIEU J.B.**, FELFOUL O., MARTEL S., BEAUDOIN G., "Magnetic Signature Selective Excitation Tracking", US Provisional Patent Application 60/693,082, Filed 2005 June 23rd.

Participation in successful Grant Applications :

- NSERC Strategic Project Grants (SPG) CAD \$ 130 000 per year, Grant Proposal: Propulsion and control of microdevices by magnetic gradients for endovascular applications, Accepted Oct. 2003.
- CFI Grant proposal, CAD \$ 4 000 000, Equipment for a Magnetic Resonance Propulsion platform for the development of BioMicroRobots, Accepted Feb. 2004.

Technical reports :

- **MATHIEU, J.B.**, MRI type magnetic field control of a minisystem for endovascular applications – preliminary study -, Technical report, École Polytechnique de Montréal (EPM), April 2002.
- **MATHIEU, J.B.**, 2004, Propulsion Method for a Ferromagnetic Body Using a Magnetic Resonance Imaging System, Master's Degree Thesis, August 2004, Ecole Polytechnique de Montreal

Conference Papers :

- MARTEL S., FELFOUL O., LU Z., ABOUSSOUAN E., **MATHIEU J.B.**, POUPONNEAU P., CHANU A., TAMAZ S., LEROUX J.C., GOURDEAU R., BEAUDOIN G., SOULEZ G., YAHIA L'H., MERHI Y., MANKIEWICZ M., Towards Swarms of Microrobots Propelled by Bacteria or Magnetic Gradients and Operating under MR-tracking and Computer Control for Precise Navigation in Human Blood Vessels, IEEE International Conference on Robotics and Automation, (2007), (In Review)
- **MATHIEU, J.B.**, MARTEL, S., "Magnetic Steering of Iron Oxide Microparticles Using Propulsion Gradient Coils in MRI", 28th Conference of the IEEE EMBS. 2006 Aug 30-sept 3, New-York, USA.
- MARTEL S., SOULEZ G., BÉLIVEAU R., **MATHIEU J.B.**, And Felfoul O. Novel Targeted Treatments of Tumors with Microparticles Driven by MRI-Based Gradients, 3rd European Medical and Biological Engineering Conference (EMBE) (2005)
- **MATHIEU J.B.**, SOULEZ G. and MARTEL S., "Potential Applications of Untethered microdevices in the Blood Vessels within the Constraints of an MRI System", 27th Conference of the IEEE EMBS. 2005 Sept 1-4, Shangai, China, p.4850 - 4853
- MARTEL S., **MATHIEU J.B.**, HINOJOSA F.A., YAHIA L'H., POUPONNEAU P., 2005. "Fundamental Design Rules for the Conception of Microdevices to be Propelled in the Blood Circulatory System through Magnetic Gradients Generated by a Clinical MRI System". 3rd IEEE-EMBS MMB conference, 2005 May 12-14, Oahu, Hawaii
- MARTEL S., **MATHIEU J.-B.**, FELFOUL O., MACICIOR H., BEAUDOIN G., SOULEZ G. et al. 2004. "Adapting MRI Systems to Propel and Guide Microdevices in the Human Blood Circulatory System". Conference Proceedings - 26th Annual International Conference of the IEEE Engineering in Medicine and Biology Society, EMBC 2004, 2004, v 26 II, p 1144-1147
- FELFOUL O., MARTEL S., BEAUDOIN G., **MATHIEU J.-B.**, 2004. "Micro-Device's Susceptibility Difference Based MRI Positioning System, a Preliminary investigation". Conference Proceedings - 26th Annual International Conference of the IEEE Engineering in Medicine and Biology Society, EMBC 2004, 2004, v 26 II, p 1144-1147
- **MATHIEU J.-B.**, MARTEL S., YAHIA L., SOULEZ G., BEAUDOIN G. 2003. "MRI Systems as a Mean of Propulsion for a Microdevice in Blood Vessels ". 25th conference of the IEEE EMBS. 17-21 Sept 2003 : IEEE. P. 3419-3422.
- **MATHIEU, J.-B.**, MARTEL, S., YAHIA, L., SOULEZ, G., BEAUDOIN, G. 2003. "Preliminary studies for using magnetic resonance imaging systems as a mean of propulsion for microrobots in blood vessels and evaluation of ferromagnetic artefacts". canadian congress on electric and computer engineering. Montreal Canada: p 835-838.

Poster Presentations :

- **MATHIEU J.B.**, POUPONNEAU P., MARTEL S., YAHIA L'H., 2005, "MR-Sub, Magnetic Resonance Submarine to Explore the Blood Vessels", NanoForum Canada, Canada Nanoscience and Nanotechnology Forum, 2005 June 15 – 17, Montreal Canada.
- Second Quebec Workshop on Nanoscience and Nanotechnology, Organized by Nanoquebec, 16th of November 2002 (Poster)

- ABOUSSOUAN E., FELFOUL O., **MATHIEU J-B.**, BEAUDOIN G., MARTEL S., Real-time projection based technique for tracking ferromagnetic devices, ISMRM 14th Scientific Meeting & Exhibition, Seattle, 6-12 May 2006, Abstract #3353