

Bernard F. Mettler

Assistant Professor
Aerospace Engineering and Mechanics
University of Minnesota

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1. Personal Data

Citizenship: Swiss

Born November 29th 1969 in Geneva, Switzerland

Languages: French, German and English

2. Degrees

Ph.D.

Department of Mechanical Engineering,
Carnegie Mellon University, Jan. 1997 – Jan. 2001

Diploma in Mechanical Engineering

Department of Mechanical Engineering,
Swiss Federal Institute of Technology (ETH),
Zurich, Switzerland, Oct. 1989 – Feb. 1996

3. Academic Experiences

Research Scientist

Laboratory for Information and Decision Systems,
Department of Aeronautics and Astronautics, MIT, Cambridge, MA

Dates: October 2004 – December 2005

Research areas: Agile maneuvering, motion planning, and autonomy.

Postdoctoral Associate

Laboratory for Information and Decision Systems,
Department of Aeronautics and Astronautics, MIT, Cambridge, MA

Dates: April 2001 – September 2004

Supervisor: Prof. Eric Feron

Research areas: Robust guidance systems for agile vehicles; system identification modeling and control system design for a small-scale acrobatic helicopter

Teaching: Designed and taught graduate course in rotorcraft dynamics and control with emphasis on unmanned aerial vehicles

Doctoral Student

The Robotics Institute and Department of Mechanical Engineering,
Carnegie Mellon University, Pittsburgh, PA

Dates: May 1997 – Jan. 2001

Dissertation Title: “Modeling Small-Scale Unmanned Rotorcraft for Advanced Flight Control Design”

Supervisors: Prof. Takeo Kanade and Dr. Mark Tischler (NASA Ames)

Research areas: System identification modeling of a small-scale autonomous helicopter; control system analysis and optimization; dynamic characteristics of small-scale rotorcraft; flying qualities and control performance requirements for autonomous flight.

Research Assistant

Automatic Control Laboratory, Department of Electrical Engineering,
Swiss Federal Institute of Technology (ETH), Zurich, Switzerland

Dates: Feb. 1996 – Dec. 1996

Supervisor: Prof. Manfred Morari

Research areas: Extension of the model predictive control (MPC) algorithm to linear parameter varying (LPV) systems. Application of LPV-MPC for the control of steam generators in nuclear power plants (Electricité de France).

4. Internships

US Army/NASA Rotorcraft Division, Flight Control Group, Moffett Field, California

Dates: July 1999 – Oct. 1999 and July 2000 – Sept. 2000

Supervisor: Dr. Mark B. Tischler

Research areas: System identification, multi-objective control system optimization, simulation, flying qualities requirements for unmanned rotorcraft.

Rolex Industries, Geneva, Switzerland

Dates: Feb. 1991 – Oct. 1991

Task: Development of a computer-controlled laboratory test system for the study of fatigue in mechanical parts.

5. Professional Services

Reviews made for

IEEE International Conference on Robotics and Automation

IEEE Transaction on Robotics and Automation

International Journal of Robotics Research

AIAA Journal of Guidance Control and Dynamics

American Control Conference

6. Military Service

Swiss Military

Rank: Lieutenant

Schools and training: Officer School (June – Oct. 1992), Under-Officer School (Jan. – May 1992), Compulsory Training (June – Oct. 1989)

7. Miscellaneous Activities

Certificate in Technology Commercialization

Graduate School of Industrial Administration
Carnegie Mellon University
Oct. – Dec. 1997

Field study: The Civilian Market for Unmanned
Aerial Technology

MIT & Harvard Business School
Jan. – May 2002

8. Professional Memberships

Associate member, IEEE, Control Systems and Robotics and Automation Society

Associate member, American Institute of Aeronautics and Astronautics (AIAA)

Member, American Helicopter Society (AHS)

9. Awards

Best conference paper, AIAA Digital Avionics System Conference 2001

Carnegie Mellon University Award for contributions to Autonomous Helicopter Project, 1997

AUVSI International Aerial Robotics Competition, First Prize winner, Orlando, Florida, 1997

10. Publications

Books

B. Mettler, *Identification Modeling and Characteristics of Miniature Rotorcraft*, Kluwer Academics
Publisher, Nowell, MA, ISBN: 1402072287, September 2002.

Journal Papers

C. Dever, B. Mettler, E. Feron, J. Popovic, and M. McConley, "Trajectory Interpolation for
Parameterized Maneuvering and Flexible Motion Planning of Autonomous Vehicles," *AIAA
Journal of Guidance, Control and Dynamics*, 29(2), 2006.

T. Schouwenaars, B. Mettler, E. Feron and J. How, "Hybrid Model for Trajectory Planning of Agile
Autonomous Aerial Vehicles," *Journal of Aerospace Computing, Information, and
Communication*, Special Issue on Intelligent Systems, Vol. 1, December 2004.

B. Mettler, C. Dever and Eric Feron, "Scaling and Dynamic Characteristics of Miniature Rotorcraft,"
AIAA Journal of Guidance, Control and Dynamics, 27(3), 2004.

- V. Gavrillets, B. Mettler and E. Feron, "Human-Inspired Control Logic for Automated Maneuvering of Miniature Helicopter," *AIAA Journal of Guidance, Control and Dynamics*, 27(5), 2004.
- B. Mettler, M. B. Tischler and T. Kanade, "System Identification Modeling of a Small-Scale Unmanned Helicopter," *Journal of the American Helicopter Society*, 47(1), Jan. 2002.
- V. Gavrillets, E. Frazzoli, B. Mettler and E. Feron, "Aggressive Maneuvering of Small Autonomous Helicopters: A Human-Centered Approach," *International Journal of Robotics Research*, 20(10), Oct. 2001.
- M. V. Kothare, B. Mettler, M. Morari, P. Bendotti, and C.-M. Falinower, "Level Control in the Steam Generator of a Nuclear Power Plant," *IEEE Transaction on Control System Technology*, 8(1), Jan. 2000.

Conference Proceedings

- B. Mettler and O. Toupet, "Receding Horizon Trajectory Planning with an Environment Based Cost-to-go Function", Proceedings of the joint ECC-CDC Conference, Seville, Spain, Dec. 2005.
- B. Mettler and Edward Bachelder, "Combining On- and Offline Optimization for Trajectory Planning of Autonomous Vehicles in Complex Missions and Environments", to appear in the Proceedings of the AIAA Guidance, Navigation and Control Conference, San Francisco, Aug. 2005.
- C. Dever, B. Mettler, and E. Feron, "Trajectory Interpolation for Parameterized Maneuvering and Flexible Motion Planning of Autonomous Vehicles," AIAA Guidance, Navigation and Control Conference, Chicago, Aug. 2004.
- T. Schouwenaars, B. Mettler, E. Feron, and J. How, "Hybrid Architecture for Receding Horizon Guidance of Agile Autonomous Rotorcraft," 16th IFAC Symposium on Automatic Control in Aerospace, St. Petersburg, Russia, June 14-18, 2004.
- B. Mettler, M. Valenti, T. Schouwenaars, A. Richards, J. How, J. Paunicka, and E. Feron, "UAV Autonomy Build-Up: Flight-Test and Demonstration Plan," AIAA Guidance, Navigation and Control Conference, Austin, Aug. 2003.
- T. Schouwenaars, B. Mettler, and Eric Feron, "Hybrid Control Architecture for Full-Envelope Autonomous Rotorcraft Guidance," 59th Forum of the American Helicopter Society, Phoenix, May 2003.
- T. Schouwenaars, B. Mettler and E. Feron, "Robust Motion Planning with a Maneuver Automaton with Built-in Uncertainties," American Control Conference, Denver, CO, June 2003.
- V. Gavrillets, I. Martinos, B. Mettler and E. Feron, "Flight Test and Simulation Results for an Autonomous Aerobatic Helicopter," AIAA/IEEE Digital Avionics Conference (DASC), Irvine, CA, Oct. 2002.
- V. Gavrillets, I. Martinos, B. Mettler and E. Feron, "Control Logic for Automated Aerobatic Flight of Miniature Helicopter," AIAA Guidance, Navigation and Control Conference, Monterey, Aug. 2002.
- M. Valenti, B. Mettler, T. Shouwenaars, and E. Feron, "Trajectory Reconfiguration for an Unmanned Aircraft," AIAA Guidance, Navigation and Control Conference, Monterey, Aug. 2002.

- B. Mettler, M. Valenti, T. Schouwenaars, E. Frazzoli and E. Feron, "Rotorcraft Motion Planning for Agile Maneuvering using a Maneuver Automaton," 58th Forum of the American Helicopter Society, Montreal, Canada, June 2002.
- V. Gavrillets, I. Martinos, B. Mettler and E. Feron, "Aggressive Maneuvering Flight Tests of a Miniature Robotic Helicopter," 8th International Symposium on Experimental Robotics (ISER), Sant'Angelo d'Ischia, Italy, July 2002.
- B. Mettler, C. Dever and Eric Feron, "Identification Modeling, Flying Qualities and Dynamic Scaling of Miniature Rotorcraft," NATO System Concepts and Integration (SCI) Symposium, Berlin, Mai 2002.
- B. Mettler, V. Gavrillets and Eric Feron, "Flight-Test Evaluation of a Dynamic Compensation for High-Bandwidth Control of a Small-Scale Helicopter," American Helicopter Society, Test and Evaluation Technical Specialists Meeting, San Francisco, CA, Jan. 2002.
- V. Gavrillets, B. Mettler and E. Feron, "Nonlinear Model for a Small-Size Acrobatic Helicopter," AIAA Guidance, Navigation, and Control Conference, Montreal, Canada, Aug. 2001.
- K. Sprague, V. Gavrillets, D. Dugail, B. Mettler and E. Feron, "Design and Applications of an Avionics System for a Miniature Acrobatic Helicopter," AIAA Digital Avionics Systems Conference, Daytona Beach, FL, Oct. 2001.
- B. Mettler, M. B. Tischler, and T. Kanade, "Attitude Control Optimization for a Small-Scale Unmanned Helicopter," AIAA Guidance, Navigation and Control Conference, Denver, CO, Aug. 2000.
- H. Mansur, M. Frye, B. Mettler, and M. Montegut, "Rapid Prototyping and Evaluation of Control System Designs for Manned and Unmanned Applications," 56th Forum of the American Helicopter Society, Virginia Beach, VA, Mai 2000.
- B. Mettler, M. B. Tischler, and T. Kanade, "System Identification of Small-Size Unmanned Helicopter Dynamics," 55th Forum of the American Helicopter Society. Montreal, Canada, Mai 1999.
- R. Miller, B. Mettler, and O. Amidi, "Carnegie Mellon University's 1997 International Aerial Robotics Competition Entry," Association for Unmanned Vehicle Systems International, Orlando, FL, June 1997.
- P. Bendotti, C.-M. Falinower, M. V. Kothare, B. Mettler, and M. Morari, " μ -Analysis and H_∞ controller Synthesis for the Steam Generator Water Level," in Proceedings of the 2nd IFAC Symposium on Robust Control Design, Budapest, Hungaria 1997.
- M. V. Kothare, B. Mettler, M. Morari, P. Bendotti, and C.-M. Falinower, "Linear parameter varying model predictive control for steam generator level control," in Proceedings of the European Symposium on Computer Aided Process Engineering-7, Trondheim, Norway, 1997.
- M. V. Kothare, B. Mettler, M. Morari, P. Bendotti, and C.-M. Falinower, "Level Control in the Steam Generator of a Nuclear Power Plant," in Proceedings of the 35th IEEE Conference on Decision and Control (CDC), Kobe, Japan, 1997.

11. Invited Talks and Panels

- MIT Department of Brain and Cognitive Sciences, Prof. S. Seung, March 2004
- ETH Zurich, IfA Seminar, Prof. M. Morari, Feb. 2003
- Panelist for UAV session of the American Helicopter Society 58th Forum, June 2002
- ETH Zurich, IfA Seminar, Prof. M. Morari, May 2002
- NASA Ames Research Center, Rotorcraft Division, Dr. Mark Tischler, Aug. 2001
- NASA Dryden flight test center, Dr. Marti Brenner, Aug. 2001
- Lockheed Martin Skunk Works, Dr. Richard Colgrane, Oct. 1999
- NASA Ames Research Center, Rotorcraft Division, Dr. Mark Tischler, Nov. 1997
- ETH Zurich, COSY workshop, Control of Complex Systems, Prof. H.-P. Geering, Sept. 1997

12. Supervised Work (jointly with faculty members)

- Marco LaCivita, Ph.D. student, Carnegie Mellon University, first principle modeling and identification of small-scale rotorcraft, Mar. – Dec. 2001
- Vladislav Gavrillets, Ph.D. student, Aeronautics and Astronautics, MIT, modeling and flight control design for small-scale aerobatic helicopter, Mar. 2001 – 2003
- Mario Valenti, Ph.D. student, Aeronautics and Astronautics, MIT, reconfigurable guidance systems for unmanned aerial vehicles, Aug. 2001 – present
- Chris Dever, Ph.D. student, Mechanical Engineering, flight data segmentation, mathematical framework for human inspired motion control, Aug. 2001 – 2004
- Tom Schouwenaars, Ph.D. student, Aeronautics and Astronautics, MIT, robust guidance systems for unmanned aerial vehicles, April 2002 – present
- Olivier Toupet, graduate student, Aeronautics and Astronautics, MIT. May 2004 – present