Vilas Kumar Chitrakaran

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EDUCATION:

- **Ph.D., Electrical Engineering**, *Clemson University*, SC, USA — August 2006
- **M.S., Electrical Engineering**, *Clemson University*, SC, USA — December 2002
- **B.E., Electrical & Electronics Engineering,** *University of Madras*, India — May 1999

RESEARCH INTERESTS/AREAS OF EXPERTISE:

- Nonlinear control: Visual servo control, estimation, adaptive systems, robust control, autonomous systems.
- Robotics: Kinematics, real-time control, tele-operation.
- Computer vision: Motion analysis, 3D reconstruction, machine vision and image processing techniques.
- System design: Device drivers (GNU/Linux, QNX), real-time system design, object oriented software design (C++), data acquisition, system integration.
- Computer graphics: Virtual reality systems, OpenGL, photo-realistic scene rendering, dynamics simulation.

RESEARCH EXPERIENCE:

Adaptive Warfare Laboratory, **Clemson University, SC: Research Associate, August 2006 – October 2006.**

- Current responsibilities include procurement of equipment and setting up lab resources.

Robotics and Mechatronics Laboratory, **Clemson University, Clemson, SC: Graduate Research Assistant August 2000 – August 2006:**

- ***Vision-based guidance, navigation and control strategies for autonomous vehicles:*** Designed vision-in-the-loop nonlinear control strategies aimed at autonomous landing and path-following for unmanned aerial vehicles (UAVs).
- ***Vision-based motion estimation and 3D reconstruction:*** Designed and implemented a prototype nonlinear estimator for identification of velocity and structure of targets in the field of view of a monocular camera. Implementation involved the development of algorithms for nonlinear estimation, image processing, video processing, and computer vision, the test bed, and an OpenGL based virtual scene viewer for the reconstructed environment. (http://www.ces.clemson.edu/~cvilas/projects/sfm)
- ***Soft robotic manipulators (DARPA Biodynotics program):*** Responsibilities included the integration of hardware and software sub-systems, design of on-board electronics and a real-time control system for the in-house developed *Octor* bio-mimetic continuum robotic manipulator mounted on a retrofitted Foster-Miller Talon unmanned ground vehicle. (http://www.ces.clemson.edu/~cvilas/projects/octor)
- ***Human factors in tele-operation of robotic systems*:** Developed experimental test beds for study of visual depth perception in remote robotic tele-operation in situations such as disaster related search and rescue operations.
- ***Robotic Platform*:** Developed and implemented manipulator servo control modules, robot kinematics and dynamics, and lower level hardware interfacing as one of the developers of a QNX based open research and development platform for industrial robotic manipulators. (http://www.ces.clemson.edu/~cvilas/projects/rp)
- ***QMath*:** Developed a real-time capable multi-platform matrix library designed for robotics, control and machine vision applications. (http://www.ces.clemson.edu/~cvilas/projects/qmath)
- ***Mechatronic system integration*:** Experience in developing hardware interfacing electronics, device drivers and complex, multi-threaded, multi-platform software components for integration into mechatronic test-rigs such as high speed video capture systems, and robotic systems.
- ***Machine shop*:** Beginner level experience in handling various hand tools, drill press and the milling machine.
- ***Administrative tasks*:** Group research web-pages, selection and procurement of lab. equipment, administration of group computing resources, mentoring junior graduate students.

TEACHING EXPERIENCE:

- Laboratory Teaching Assistant, ECE Dept., Clemson University, Clemson, SC, July 2001.
- Lectured senior level classes on Robotics and Control Systems topics on occasions.

INDUSTRIAL EXPERIENCE:

- Eveready Industries India Limited (formerly Union Carbide), Summer Intern, 1999.

PUBLICATIONS:

Theses:

- Vilas K. Chitrakaran, "Lyapunov-Based Nonlinear Estimation and Control Using Vision in the Loop," *Ph.D. Thesis*, Dept. of ECE, Clemson University, August 2006.
- Vilas K. Chitrakaran, "The Robotic Platform – Implementation of the Manipulator Classes and the Math Library," *Master's Thesis*, Dept. of ECE, Clemson University, December 2002.

Selected Journal Papers:

- V. K. Chitrakaran, D. M. Dawson, W. E. Dixon, and J. Chen, "Identification of a Moving Object's Velocity with a Fixed Camera," *Automatica*, Vol. 41, No. 3, pp. 553 – 562, March 2005.
- Markus S. Loffler, Vilas Chitrakaran, and Darren M. Dawson, "Design and Implementation of the Robotic Platform," *Journal of Intelligent and Robotic Systems*, Vol. 39, No. 1, pp. 105 – 129, January 2004.

Selected Conference Papers:

- V. K. Chitrakaran, D. M. Dawson, H. Kannan, and M. Feemster, "Vision Assisted Autonomous Path Following for Unmanned Aerial Vehicles," *Proc. of the 45th IEEE Conference on Decision and Control*, Dec. 2006, accepted, to appear.
- V. Chitrakaran, D. Dawson, J. Chen, and H. Kannan, "Velocity and Structure Estimation of a Moving Object Using a Moving Monocular Camera," *Proc. of the 25th American Control Conference*, pp. 5159-5164, June 2006.
- W. McMahan, M. Pritts, V. Chitrakaran, D. Dienno, B. Jones, M. Grissom, M. Csencsits, V. Iyengar, I. Walker, C. Rahn, and D. Dawson, "Field Trials and Testing of the Octarm Continuum Manipulator," *2006 IEEE International Conference on Robotics and Automation*, pp. 2336-2341, May 2006.
- V. K. Chitrakaran, D. M. Dawson, J. Chen, and M. Feemster, "Vision Assisted Autonomous Landing of an Unmanned Aerial Vehicle," *Proc. of the 44th IEEE Conference on Decision and Control*, pp. 1465-1470, Dec. 2005.
- V. K. Chitrakaran, D. M. Dawson, J. Chen, and W. E. Dixon, "Euclidean Position Estimation of Features on a Moving Object Using a Single Camera: A Lyapunov-Based Approach," *Proc. of the 24th American Control Conference*, pp. 4601-4606, June 2005.
- Jones, B., McMahan, W., and Walker, I.D., Chitrakaran, V., Seshadri, A., and Dawson, D., "Robotic Manipulators Inspired by Cephalopod Limbs," *CDEN Symposium on Biomimicry, Bionics, and Biomechanics*, Montreal, Canada, July 2004.
- V. K. Chitrakaran, A. Behal, D. M. Dawson and I. D. Walker, "Setpoint Regulation of Continuum Robots Using a Fixed Camera," *Proc. of the 23rd American Control Conference*, pp. 1504-1509, June 2004.

Papers Under Review:

- V. K. Chitrakaran, D. M. Dawson, J. Chen, and W. E. Dixon, "Euclidean Position Estimation of Features on an Object Using a Single Camera - A Lyapunov-Based Approach," *IEEE Trans. in Control Systems Technology*, submitted.
- V. K. Chitrakaran, D. M. Dawson, H. Kannan, and M. Feemster, "Vision-Based Tracking for Unmanned Aerial Vehicles," *IEEE Trans. in Robotics*, submitted.

PRESENTATIONS:

- *American Control Conference, Minneapolis (USA), 2006*: Whole arm grasping control of redundant robot manipulators, Velocity and structure estimation of a moving object using a moving monocular camera, Multiple UAV navigation with finite sensing zone, Adaptive state-of-charge estimator for a battery.
- *Conference on Decision and Control, Seville (Spain), 2005*: Adaptive nonlinear tracking control of kinematically redundant robot manipulators with sub-task extensions, Hierarchical adaptive controller for a nonlinear aeroelastic wing section with multiple control surfaces, Vision assisted autonomous landing of an unmanned aerial vehicle.

- *American Control Conference, Boston (USA), 2004*: Setpoint regulation of continuum robots using a fixed camera, Adaptive regulation of amplitude limited robot manipulators with uncertain kinematics and dynamics.

PUBLICATION REVIEW WORK:

- IEEE/ASME Transactions on Mechatronics
- IEEE Transactions on Systems, Man and Cybernetics
- IEEE Transactions on Control Systems Technology
- The International Journal of Robotics Research
- American Control Conference
- Conference on Decision and Control

AWARDS:

- Silver Medal, Bachelor of Engineering (Electrical and Electronics), University of Madras, India, 1999.

AFFILIATIONS:

- Institute of Electrical and Electronics Engineers (IEEE): Member, 1996-current.
- Association for India's Development, a 501 (C) (3) non-profit charity organization: Volunteer, 2000-current.

NATIONALITY AND VISA STATUS

- Indian national, currently on US F-1 (student) Visa.

REFERENCES:
Available on request