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Objective

Details of my educational and professional expertise are briefly presented for your consideration to pursue a suitable position

1. Education

The Ohio State University, Columbus, OH
Ph.D., Aeronautical and Astronautical Engineering, Dec. 1994
Dissertation: *Eigenvalue and Eigenvector Perturbations for Time Response Analysis of Linear Uncertain Systems*

Indian Institute of Science, Bangalore, India
M.E., Aerospace Engineering, Oct. 1984
An Efficient Algorithm for Determination of Satellite Orbits from a Single Station

Anna University, Madras, India
B.Tech., Aeronautical Engineering, June 1982

Madras University, Madras, India
B.Sc., Mathematics, April 79

2. Professional Experience

2.1 August 16, 2005 – Oct 16, 2005
Professor, Hindustan College of Engineering, Old Mahabalipuram Road, Padur (Via), Kelambakkam, 603 103, India.

Tracking Functional Mutations in 'Molecular Systems Biology' Framework

The nucleotide sequences of complex traits across an atom to organ pathway are highly directional for Watson-Crick DNA base pairs (or ribosome encoded amino acid sequence selection and a native fold) to occur. Cell Biology is elegantly put in a nutshell in System and System of Networking Systems framework. A dynamic system is derived and Lyapunov theory is applied. Time varying orthogonal vectors and inertia (instead of a convex positive definite matrix choice in Systems and Controls discipline) are identified to interpret protein conformations and sequence directionality. A discipline to integrate Piecewise Linear Systems, Vector Mechanics, Graph Theory, Biology and Biochemistry is envisioned to conduct predictive experiments.

2.2 November 3, 2004-August 15, 2005
490, 19th Main Road, Bangalore 560 041, India.

Structured Singular Values Based String Theory
The mechanistic biological science evolved through clinical trails can be mathematically programmed, an important step to realize biological signals through bits. An attribute of these signals is that they are vector processors designed to engage hybrid multi-scale time–frequency components, which can be visualized using a Geometric Vector Space. Structured singular values play a crucial role in Molecular Assembly of Biological Complex Systems. To this end, procedure to solve Structured Singular Values formulated by Professor John C. Doyle has been identified. Several examples have been solved.

2.3 July 7, 2004-November 3, 2004
19 Wexford Drive, Monmouth Junction, NJ 08852.

An Integrated Computing Platform for Engineering and Life Science Applications
Complex mathematical models are successfully linked to directed graphs. Systems theory and vector mechanics of linear algebra are carefully integrated to analyze and interpret Microarray Data. Considering nodes, edges, directed arcs and dimensional uncertainties, promising procedures for analysis of metabolic pathways and modeling and simulation of molecular assemblies in multi-scale time-frequency analysis are envisioned.

2.3 July 8, 2002-July 7, 2004.
Senior Research Associate, National Research Council
Air Force Research Laboratory, Eglin AFB, Florida.

Communication and Control of Distributed Systems
Procedures to control distributed systems in formations are presented. Interconnections and communication patterns are systematically studied for a hierarchical architecture where control of distributed systems for assignment operations is mixed with decisions and feasibility of operating points. It is shown that by introducing relative string stability with respect to a signal, interconnections can assist to organize dynamics of complex systems, multi-scale modeling, computing platforms, communication and control.

2.4 August 23, 2000-June 30, 2001
Visiting Assistant Professor
University of Miami, Coral Gables, Florida

Reconfigurable Architecture
A procedure to use miniature sensor-actuator combination for risk mitigating rationale in structural components is presented. An algorithm to assess and engage or disengage a transducer signal in reconfigurable architecture is developed. Usually, in a control system design, sensor and actuator signals are simultaneously processed. In problems such as distributed parameter system governed by partial differential equations, instability could be due to a particular sensor that transmits an unbounded signal to the actuator. When these signals are carefully monitored and disengaged, control operation could be safe. With distributed transducers such as piezoceramic and nano-sensors and actuators, such a networking in reconfigurable architecture is possible. This principle was demonstrated using finite elements and a suitable uncertainty profile that leads to risk.

Courses taught	Numerical Methods of Engineering Analysis Flight Dynamics Aircraft Structures Advanced Solid Mechanics with Finite Elements Measurements and Controls and Course Laboratory
Engineering Software	Pro-E for Solid Modeling and Finite Element Analysis Matlab for Numerical Integration Schemes LabView for Real Time Data Acquisition and Processing

2.5 August 15, 1994-August 22, 2000
NASA Center for Aerospace Research
Greensboro, NC 27411

Control with Exogenous Input Predictive Sensors
An adaptive recursive control algorithm for gust alleviation in a turbulent time window is applied. A laser based forward-looking sensor (lidar) is assumed to predict changes in a state-space model due to unsteady aerodynamics.

Diagnosis of Dynamic Systems
Finite element models for a cantilever beam with fairly a large number of velocity sensors are assumed. Range of stabilizing gains for each velocity sensor with respect to a actuator at the fixed end of the beam is determined. The elements of the gain space for healthy and unhealthy beam are scheduled to understand sensor allocation problems. Actuator allocation in multi-input setting is similar in procedure but complex in nature.

Courses taught	Linear systems theory Electric circuit analysis
Software	Matlab, Latex Text, Showcase, WordPro, Freelance

2.6.1 Sep. 1990 – Aug. 1994
Graduate Research Associate
The Ohio State University, Columbus, OH

Multivariable Control
Developed various utility files for Matlab that enables to study parameter varying systems using composite matrix theory.
Performed literature survey Dynamics and Control of Powertrain Systems

2.7 March 1986 - September 90
Aeronautical Development Agency, Bangalore, India

Nonlinear Control Design and Simulation
Participated in flight control design, analysis and simulation aspects of Indian

Defense and Research Laboratory's combat aircraft program
Designed inner and outer loop pitch control configurations
Developed extensive MATLAB codes for real-time control and simulation

2.8 January 1986 - March 1986
Indian Space Research Organization, Hassan, India

Introduced to ground control commands to maintain INSAT orbit, a communication satellite

2.9 August 1982 - December 1986
Indian Institute of Science, Bangalore, India

Nonlinear and Linear Modeling
Systematically investigated non-linear model of a flexible rocket with propellant slosh, sensor and servo-engine interactions. Deduced simplified linear models for design and analysis. Effects of piecewise linear modeling errors along a trajectory are analyzed using discrete and continuous time controllers. Enhanced stability and performance by supplementing structural filters

Extended Kalman Filter Application in Orbital Mechanics
Reviewed batch and sequential methods for orbit determination. Derived a model for LEO satellite to accommodate short arc data from a single tracking station. Applied U-D factors in Extended Kalman Filter to increase accuracy of the orbital elements. Coded an algorithm to predict orbits without control torque for attitude correction.

3.1 JOURNAL PUBLICATIONS

1) Ashokkumar, C.R., and Rao, S.S., Structural Control Using Inverse Optimal Control Theory, AIAA Journal, December 2003, Vol. 41, No. 12, pp.
2) Ashokkumar, C.R., and Yedavalli, Rama, K., Eigenstructure Perturbation Analysis in Disjointed Domains for Linear Uncertain Systems, *International Journal of Control,* Vol. 67, No. 6, 1997, pp 887-899.
3) Yedavalli, Rama, K., and Ashokkumar, C.R., Time Response Bounds for Linear Parametric Uncertain Systems, *International Journal of Systems Science*, Feb 2000, Vol. 31, No. 2, pp 177-188.
4) Ashokkumar, C.R., Linear Quadratic Optimality of Infinite Gain Margin Controllers, *Journal of Guidance, Control, and Dynamics*, Vol. 22, No. 5, 1999, pp 720-722.
5) Ghoshal, A., Wheater, E.A., Ashokkumar, C.R., Sundaresan, M.J., Schulz, M.J., Human, M., and Pai, F., Vibration Suppression Using Laser Vibrometer and Piezoceramic Patches, *Journal of Sound and Vibration*, Vol. 235, No. 2, August 2000, Page 261-280.
6) Ashokkumar, C.R., Ghoshal, A., Sundaresan, M.J., Schulz, M.J., Human, M. Vibration Suppression Using Reconfigurable Control, accepted, *International Journal of Mechanics and Control*, Pozzo Gonti Pub., Turin, Italy.
7) Ashokkumar, C. R., Robert A. Murphey, and Robert L. Sierakowski, Mesh Stability in Formation of Distributed Systems, Book Chapter, Cooperative Control Conference, Kluwer Academic Publishers.

3.2 UNPUBLISHED WORK

1) Dynamic Feasibility of Cooperative Systems
2) On the Classification of Waypoints for Formation of Distributed Systems
3) Formation of Distributed Systems using Linear Quadratic Previewed Control
4) Relative String Stability and Control of System of Lyapunov Systems [Book Chapter extensions]
5) Computational Intelligence for Unstructured Communication Patterns in Control of Distributed Systems
6) Eigenvalue and Eigenvector Invariance and Real Parametric Stability Margins
7) Exact Structured Singular Values in Null Space
8) Multi-Variable Root Locus
9) Evolution of Matrix Singularities in Systems and Controls
10) Design and Analysis of Communication Patterns in Control of Distributed Systems
11) Kinematic Coupling in Flight Envelope
12) Directional Feasibility of MAV's in Formations
13) An Introduction to Biological Finite Elements
14) The Role of Virtual and Natural Interconnections in Complex Systems
15) Stability and Optimality of Reconfigurable Systems
16) Exact Performance Bounds for Stable Polytopic Linear Systems
17) Biological Lyapunov Theory ; Discrete and Continuous Cases
18) Computational Systems Biology: Tracking Mutations in Networks of Networks

3.3 PATENT OPTIONS

The proposed work has potentials to secure patents (or) publish papers in archival journals and work towards major awards recognizable by scientific communities

3.4 CONFERENCE PUBLICATIONS

1) Ashokkumar, C.R., Will J. Curtis, and Robert A. Murphey, Formation Control of Distributed Systems: Computation versus Cooperation, *2nd AIAA Unmanned Unlimited Systems, Technologies, and Operations-Aerospace, Land, and Sea Conference and Workshop & Exhibit*, San Diego, California, 15-18 Sep 2003, Paper 6621.
2) Ashokkumar, C.R., and David E. Jeffcoat, Cooperative Systems Under Communication Delay, AIAA Guidance, Control, and Navigation Conference, Austin, TX 11-13 Aug 03, AIAA Paper 2003-5663
3) Ashokkumar, C.R., Will Curtis, Rob Murphey, and Robert Sierakowski, Invariant Interconnected Systems, Cooperative Control Conference, Gainesville, FL 4-6 Dec 02.
4) Ashokkumar, C.R., Williams, R., and Homaifar, A., Supplemental Control for Flight Cruise with Turbulence in Discrete Time Windows, In the Proceedings of *1997 American Control Conference,* pp 1116.
5) Ashokkumar, C.R., Optimal Bode Plots for Single Input Systems: An Application to D-stabilizing Compensators, Paper AIAA 96-3906, *AIAA Guidance, Navigation and*

Control Conference, San Diego, CA, July 1996.

6) Ashokkumar, C.R., Homaifar, A., and Yedavalli, Rama K., Dominant Pole Assignment in Linear Uncertain Systems, Paper AIAA 96-3907, *AIAA Guidance, Navigation and Control Conference*, San Diego, CA, July 1996.
7) Ashokkumar, C.R., and Yedavalli, Rama K., Time Response Bounds for Linear Uncertain Systems, In the Proceedings of the *33rd IEEE Conference on Decision and Control*, Dec. 1994, pp 56-61.
8) Yedavalli, Rama K., and Ashokkumar, C.R., Eigenstructure Perturbations in Disjointed Domains for Linear Systems with Structured Uncertainty, In the Proceedings of *AIAA Guidance, Navigation and Control Conference*, Scottsdale, AZ, Aug. 1994, pp 358-367 (Paper AIAA-94-3582-CP).
9) Ashokkumar, C.R., and Yedavalli, Rama K., Robust Control of Quarter Car Models: A Case Study with Real Parameter Variations, In the Proceedings of *ASME Winter Annual Meeting* , Chicago, IL, Nov. 1994, DE.Vol 75, pp. 511-517.
10) Ashokkumar, C.R., and Reddy, B.S., Robust Structural Mode Suppression in an Unstable Aircraft for Modal Mass Uncertainties, In the Proceedings *of International Conference on Advances in Structural Testing, Analysis, and Design*, Bangalore, India, 1990.
11) Bhat, M.S., Ashokkumar, C.R., and Shrivastava, S.K., Control Structure Interactions in a Rocket, In the Proceedings of *INDO and US Conference on Systems and Signal Processing*, Bangalore, India, 1989.

3.5 TECHNICAL REPORTS

1) Ashokkumar, C.R., and Reddy, B.S., Adaptation of Mirage 2000 Control Law Structure for Light Combat Aircraft, Aeronautical Development Agency, Bangalore, India, March 89, 20 Pages.
2) Bhat, M.S., Ashokkumar, C.R., and Shrivastava, S.K., Structure Control Interactions in Rockets: Modeling and Validation of Analog Controller with Flexibility, Propellant Slosh, Engine, and Actuator Interactions, Joint Advanced Technology Program, Indian Institute of Science, Report No. JATP-SKS-015, Oct. 85, 72 Pages.
3) Ashokkumar, C.R. Bhat, M.S., and Shrivastava, S.K., Structure Control Interactions in Rockets: Instability Source from Engine and Actuator Interactions, Joint Advanced Technology Program, Indian Institute of Science, Report No. JATP-SKS-008, May 86, 23 Pages.
4) Bhat, M.S., Ashokkumar, C.R., and Shrivastava, S.K., Structure Control Interactions in Rockets: Validation of Digital Controller with Flexibility, Propellant Slosh, Engine, and Actuator Interactions, Joint Advanced Technology Program, Indian Institute of Science, Report No. JATP-SKS-029, Dec. 86, 31 Pages.

VISION STATEMENT:

Bio-Agents and Bio-molecules are communicating and computing machines. Such systems are autonomous and networks with neighboring systems to develop a formation. They could be either homogenous or heterogeneous. Several of the formations studied in my candidacy are cooperative but not biologically driven. This resume intends to provide supporting mechanisms

to develop biological formations (**Vision**). In fundamental science, an important and demanding requirement is to develop cooperative behavior of biological molecules along pathways. The pathways are structure-function-sequence orchestrated. This resume suggests systems biology concepts. If *engineering expertise to life sciences* is linked, it is possible to provide innovative machinery to address several problems in Life Sciences (**Statement**).

References:

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