AGENDA

2012 CINS Annual Seminar

Session One

Date: 10 August 2012

Venue: Board Room, Building 19, Rockhampton Campus

Agenda and Title	Presenter	Time Slot
1. Constrained Set-Membership Filtering	Dr Fuwen Yang	8:30am-9:20am
2. Network-Based Fuzzy Static Output Feedback Tracking Control for Van der Pol's Oscillators	Mr Dawei Zhang	9:20am-10:10am
Morning Tea		10:10am-10:30am
3. Quantitative Analysis and Synthesis for Networked Control Systems with Non-Uniformly Distributed Packet Dropouts and Interval Time-Varying Sampling Periods	Dr Yu-Long Wang	10:30am-11:20am
4. Stability and Passivity of Feedback Interconnected Systems in Network Environments	Ms Jia Wang	11:20am-12:10pm
Lunch		12:10pm-1:30pm
5. A Novel Self-Triggered Sampling Scheme in Networked Control Systems	Dr Chen Peng	1:30pm-2:20pm
6. Decision-Making and Finite-time Motion Control for a Group of Robots	Mr Qiang Lu	2:20pm-3:10pm
Afternoon Tea		3:10pm-3:30pm
7. A Brief Introduction to Event-Trigger Mechanism	Mr Bo Liu	3:30pm-4:20pm
Group Discussion		4:20pm-5:00pm

Abstracts

Presenter: Dr Fuwen Yang

Title: Constrained Set-Membership Filtering

Abstract: Set-membership filtering is to provide a set of state estimates in a state space, which always contains the true state of the system by assuming hard bounds instead of stochastic descriptions on the system noises. The actual estimate is a set estimation and not a point estimation (for example, Kalman filtering). This talk will address an interesting problem of set-membership filtering for systems with state constraints, which arise in many practical applications. For example, in vehicle tracking, an equality constraint can arise from the vehicle position when the vehicle is travelling on a known road (straight line or curve). Such a tracking problem can be regarded as a filtering problem incorporating a state constraint with the road network information from digital maps. The talk will cover set-membership filtering for linear systems with state constraints.

Biography: Fuwen Yang received his PhD in Control Engineering from Huazhong University of Science and Technology in 1990. From 1990 to 2003, he worked at Fuzhou University, China, where he became a professor. From 2003 to 2009, he worked as Research Fellow at King's College London and Brunel University, U K. In 2009, he served as a Chair Professor at East China University of Science and Technology, China. Currently, he is working at Centre for Intelligent and Networked Systems, Central Queensland University, Australia. His main research interests include set-membership filtering, control and filtering for unreliable networked systems. He has served as editorial board member for several journals. He is a Senior Member of the IEEE.

Presenter: Mr Dawei Zhang

Title: Network-Based Fuzzy Static Output Feedback Tracking Control for Van der Pol's Oscillators

Abstract: Van der Pol's oscillator is a classical model which was originally developed for an electrical circuit with a triode valve. This model has been widely studied as a host of a rich class of dynamical behaviours, including chaos, Hopf bifurcation, limit cycles and relaxation oscillations. In this paper, we deal with output tracking control of Van der Pol's oscillators which are represented by T-S fuzzy models. Notice that it is impossible to achieve the tracking control objective by using a fuzzy static output feedback controller without a time-delay. However, by intentionally introducing network-induced delays in the feedback control loop, a stable and satisfactory tracking control can be produced. Taking network-induced delays into account, the network-based nonlinear control system is described by an asynchronous T-S fuzzy system with an interval time-varying delay. Using the knowledge of the interval delay and the asynchronous characteristic, a complete Lyapunov-Krasovskii functional and a new relaxation method are proposed to derive some delay-dependent criteria for tracking performance analysis and controller design. A numerical example is given to show the effectiveness of the proposed method.

Biography: Dawei Zhang is currently working toward the PhD degree in Central Queensland University. His research interests include tracking control, fuzzy control and network-based control systems.

Presenter: Dr Yu-Long Wang

Title: Quantitative Analysis and Synthesis for Networked Control Systems with Non-Uniformly Distributed Packet Dropouts and Interval Time-Varying Sampling Periods

Abstract: This paper is concerned with quantitative analysis and synthesis for a networked control system under simultaneous consideration of non-uniformly distributed packet dropouts and interval time-varying sampling periods. A new packet dropout separation method is proposed to separate packet dropouts from the lump sum of network-induced delays and packet dropouts. An interval time-varying sampling period approach, which is more general than a switched sampling period approach, is presented to model the variation of the sampling period. Then a packet dropout decomposition based Lyapunov functional is

constructed to drive some stability criteria. Based on these stability criteria, state feedback controllers are designed to asymptotically stabilize the networked systems in the sense of mean-square.

Biography: Yu-Long Wang obtained his PhD from Northeastern University, China. Currently, he is with Centre for Intelligent and Networked Systems, Central Queensland University. He has published more than 40 research articles/papers both in journals and refereed conferences. His research interests include networked control systems, fault detection, heading control of ships, etc.

Presenter: Ms Jia Wang

Title: Stability and Passivity of Feedback Interconnected Systems in Network Environments

Abstract: This presentation focuses on stability and passivity of negative feedback interconnection of two passive systems, which are interconnected through communication networks. The insertion of communication networks between negative feedback interconnected passive systems inevitably induces delays and data packet dropouts. To model the network-based negative feedback interconnected system, an appropriate network scheduling method is presented to deal with time-varying network-induced delays and data packet dropouts. By constructing a novel discontinuous Lyapunov-Krasovskii functional, a less conservative sufficient condition for the network-based feedback interconnected system to be asymptotically stable is derived. Based on the stability condition, a new sufficient condition to make the negative feedback interconnected system in network environments remain passive is developed. A numerical example is provided to demonstrate the effectiveness of the design method.

Biography: Jia Wang received her B.Sc. degree in Mathematics in 2005 from Liaoning University and M.Sc. degree in Operational Research and Cybernetics in 2008 from Northeastern University, Shenyang, China. Currently, she is pursuing her Ph.D. degree in Central Queensland University, Australia. Jia Wang's research interests include networked control systems, time delay systems, passive analysis and control, dissipative analysis and control.

Presenter: Dr Chen Peng

Title: A Novel Self-Triggered Sampling Scheme in Networked Control Systems

Abstract: This paper proposes a novel self-triggered sampling scheme for the execution of sampling in networked control systems by taking into consideration network-induced delay and data dropout. Using this scheme, the next sampling period is dynamically obtained with respect to (a) the desired performance; (b) the latest accepted time-stamped control packet; and (c) the allowable network-induced delay bound and the maximum allowable number of successive data dropouts. This scheme can adaptively adjust the sampling period to reduce communication loads while maintaining the desired control performance. Compared with some existing ones, this scheme does not require continuous measurement of the system's states and on-line estimation of a triggering condition. An inverted pendulum is employed to demonstrate the effectiveness of the proposed scheme.

Biography: Chen Peng was born in 1972 in Jiangsu, China. He received his M.Sc and Ph.D. degrees from Chinese University of Mining Technology in 1999 and 2002 respectively. From 2002 to 2004, he was a Post-doctoral Research Fellow in Applied Math at Nanjing Normal University. From November 2004 to January 2005, he was a Research Associate at Hong Kong University. From July 2006 to August 2007, he was a visiting scholar at Queensland University of Technology. From July 2010 to August 2012, he was a visiting professor at Central Queensland University. He is currently a full Professor at Nanjing Normal University. His research interests include analysis and synthesis of networked control systems, distributed control systems and fuzzy control systems. His publications have attracted significant interest with 800 citations and h-index of 13.

Abstracts

Presenter: Mr Qiang Lu

Title: Decision-Making and Finite-time Motion Control for a Group of Robots

Abstract: This paper deals with the problem of odor source localization by designing and analyzing a decision-control system for a group of robots. In the decision level, concentration magnitude information and wind information detected by robots are used to predict a probable position of the odor source. Specifically, the idea of particle swarm optimization is introduced to give a probable position of the odor source in terms of concentration magnitude information. Moreover, an observation model of the position of the odor source is built according to wind information and a Kalman filter is used to estimate the position of the odor source, which is combined with the position obtained by using concentration magnitude information in order to make a decision on the position of the odor source. In the control level, two types of the finite-time motion control algorithms are designed; one is a finite-time parallel motion control algorithm while the other is a finite-time circular motion control algorithm. Precisely, a nonlinear finite-time consensus algorithm is first proposed and a Lyapunov approach is used to analyze the finite-time convergence of the proposed consensus algorithm. Then, on the basis of the proposed finite-time consensus algorithm, a finite-time parallel motion control algorithm, which can control the group of robots to trace the plume and move toward the probable position of odor source, is derived. Next, a finite-time circular motion control algorithm, which can enable the robot group to circle the probable position of the odor source in order to search for odor clues, is also developed. Finally, the performance capabilities of the proposed decision-control system are illustrated through the problem of odor source localization.

Biography: Qiang Lu received his Bachelor and Master degrees in control theory and control engineering from the East China University of Science and Technology, in 2000 and 2005, respectively. In 2007, he joined Hangzhou Dianzi University, Hangzhou, China. Currently, he is a Ph.D. candidate in Central Queensland University. His research interests cover cooperative control of multi-robot systems, swarm intelligence, and their applications for human security.

Presenter: Mr Bo Liu

Title: A Brief Introduction to Event-Trigger Mechanism

Abstract: In traditional time-driven sampling control, the controller computes the control when receiving new data from the sampler which sample data in predetermined sampling rates. This may lead to unnecessary computing of the controller and over-transmitting of data when there is no significant change of the state. In order to overcome these disadvantages, the event-triggered control mechanism is brought out. In event-triggered control mechanism, the sensor samples a new data when the state of the plant overtakes a threshold, which decreases the burden of control law computing and data transmission. Event-triggered controller can create a better balance between system performance and. Since the event-triggered control is first given by Arzen, it has drawn much attention of researchers' in control theory and many results have been published in literature. Here, we will firstly give a brief review about the existed results; then, the main event-triggering conditions are analyzed and compared; at last, some future issues in the design of event-triggering controllers will be discussed.

Biography: Bo Liu is currently working towards the PH.D in Central Queensland University. His research interest includes networked control system and robust control.