DEPARTMENT OF COMPUTER SCIENCE
UNIVERSITY OF HOUSTON

FACULTY CANDIDATE SEMINAR 2012

WHEN: FRIDAY, FEBRUARY 24, 2012
WHERE: PGH 232
TIME: 11:00 AM

SPEAKER: Dr. Guoning Chen, University of Utah

Host: Dr. Zhigang Deng

TITLE: Toward Efficient Vector Field Analysis and Control

Abstract: In this age of information, data with heterogeneous characteristics and increasing sizes are generated everywhere. Visualization techniques are sought to help data owners efficiently extract information contained in the data for later decision making and communication with experts from different disciplines. In this talk, I showcase how I address this need through solving the problem of analysis and control of vector field data. Vector fields are widely used to study various areo- and hydro- dynamical systems that dominate many physical and natural phenomena in the world. Applications that study these dynamical systems, such as computational fluid dynamics, automotive and aircraft design, weather study and oceanography, generate large amount of vector data that need process. Flow recurrent dynamics, such as stagnant points and re-circulating flows, are among those important flow behaviors interesting to the domain experts.

Computing vector field topology is an efficient way to detect not only the flow recurrent dynamics but also their connectivity which in turn partitions the flow domain into smaller regions for easy interpretation. I will show how vector field topology can be defined and computed robustly with the aid of Morse decomposition, a mathematical tool recently introduced to the flow visualization community. Compared to conventional vector field topology, which is based on its differential definition, Morse decomposition provides more room to tolerate error and uncertainty introduced during the data acquisition and numerical computation, leading to more stable results.

The interpretation of the results can then be conducted rigorously. In addition, I will demonstrate how the analysis of vector fields can benefit the design and control of them for a wide range of computer graphics applications that need vector fields as the input, such as texture synthesis, non-photorealistic rendering, geometric modeling and geometry processing, and computer animation.

Bio: Guoning Chen is a postdoctoral research fellow in Scientific Computing and Imaging (SCI) Institute at the University of Utah. He received the bachelor's degree in 1999 from Xi'an Jiaotong University, China and the master's degree in 2002 from Guangxi University, China. In 2009, he earned the PhD degree in Computer Science from Oregon State University. During the master study, he was working on the problem of transaction management for distributed databases. Before joining Oregon State University, he was an instructor in the Department of Computer Science and Technology at Guangxi University where he was awarded the first-prize in a young instructor teaching contest. His current research interests include scientific data visualization and analysis, topological-based method in visualization, geometric modeling and geometry processing, and computer graphics. He has served on the program committees of a number of conferences and reviewed for several journals and conferences. He is a member of the IEEE and ACM.