



<b>TOPIC</b>	<b>Time Delay in Internet Based Control Systems</b>
<b>ORGANIZERS</b>	Student Leadership Council and Faculty of ACIT Institute and TECHLAV Center
<b>AREA</b>	Mechanical Engineering
<b>SPEAKER</b>	Christopher Thomas, Ph.D. student
<b>DATE</b>	Friday April 28, 2017
<b>TIME</b>	3:00 – 4:00 P.M. (EST)
<b>VENUE</b>	Fort IRC 410, North Carolina A&T State University, UTSA and SIPI will be joining through video-conferencing
<b>FEES</b>	No Charge

## SYNOPSIS

Teleoperation is a very useful tool when an environment is too dangerous or out of reach for a human (e.g. handling nuclear material, space exploration, and performing small scale precision surgery, etc.). However, there are several problems to be addressed when using teleoperation such as disruptions, delays, interruptions, and uncertainties. Amongst these problems, time delay will be the focus of this talk. When tele-operating systems are run through various private media transmission, the delay value is very small. Thus, the delay can be assumed to be constant and can be well modeled. The Internet, on the other hand, is a public and shared resource in which many end users transmit data through the network simultaneously. The route for transmission between two end points is not fixed and varies dynamically. Also, traffic jams may be caused when too many users use the same route simultaneously. The transmission latency of such public network is difficult to estimate and predict. Time delay is one of the critical obstacles in realizing reliable Internet-based process control systems. Using analytical solutions of delay differential equations and time-domain responses, the time delay caused by communication is estimated. These estimated delay values can be used in conjunction with a Smith Predictor Controller for stabilizing delayed systems. Smith Predictor Controllers have the potential for stable teleoperation through the Internet. This is demonstrated with UDP communication on multiple agents and their ability to reach a consensus through the Internet.

## ABOUT THE SPEAKER



Christopher Thomas received his B.S. from North Carolina A&T State University in Mechanical Engineering in May 2016. He is currently pursuing his Ph.D. in Mechanical Engineering at North Carolina A&T State University. His research interests include control systems, managing time delay, stabilizing unpredictable delayed systems, and UAV teleoperation.