Cleveland State University
College of Science

COLLOQUIUM

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Maximizing Flow over Space Networks using Temporal Graphs and Sheaves
Friday February 21st at 3pm in RT 1516

Bio: Dr. Short has been a Visiting Assistant Professor in the Department of Mathematics and Computer Science at John Carroll University since 2018. He earned his M.S. and Ph.D. degrees in Mathematics from Lehigh University in 2018. During the summer of 2019, he served as a faculty fellow in the Space Communications and Navigation division at NASA Glenn Research Center. His research interests include topological robotics, applied algebraic topology, combinatorics and graph theory, delay-tolerant networking.

Abstract: With the increased presence of humans in space, there is an increased need for understanding how networking can work in interplanetary environments. Unlike Earth networks, the dynamics of planet motion and motion of objects in space causes several difficulties in translating traditional networking theory to space networks. The new networking theory relevant to space networks often gets the name "Delay/Disconnection-Tolerant Networking" or "DTN" due to the delays and disconnections inherent to space networks. The flexible nature of this networking theory has made finding mathematical frameworks that are effective at describing or comparing DTN models more challenging than anticipated. The goal of this work is to argue for a mathematical foundation for DTN models that allows us to effectively compare different properties. To this end, we have constructed models of proposed space networks and computed the maximum amount of information flow over each network using our techniques. The key tool that we introduce to the literature is the Temporal Flow Network, a time-varying graph that allows us to model known delays/disconnections effectively. In addition, we point to the theory of sheaves as a means of introducing consistency into data flow over space networks. In this talk, we will describe the problems of DTN and why Temporal Flow Networks are an effective model for a typical space network. We will also discuss how sheaves may be useful in translating traditional networking tools into a DTN framework.

Refreshments at 2:30pm in RT 1517