

FRANKLIN & MARSHALL COLLEGE  
and  
MILLERSVILLE UNIVERSITY

**A *Virtual* Joint Colloquium in Mathematics**

Thursday, October 15th, 2020, 4:00–5:00pm EDT

<https://fandm.zoom.us/j/99693312773>

**James Gossell, Ph.D. candidate at Clemson University**

**Optimal placements of Phasor Measurement Units on Power Systems**

**Abstract:** Every electric power system can be modeled by a graph  $G$  whose vertices represent electrical buses and whose edges represent power lines. A *phasor measurement unit* (PMU) is a monitor that can be placed at a bus to observe the voltage at that bus as well as the current and its phase through all incident power lines. The problem of monitoring the entire electric power system using the fewest number of PMUs is closely related to the well-known vertex covering and dominating set problems in graph theory.

In this talk, we will give an overview of the PMU placement problem and its connections to commutative ring theory. We will look at the case when  $G$  is a tree and solve the PMU problem for a particular subset of trees. Finally, by defining the *power edge ideal*  $I_G^P$  of a graph  $G$ , we will show how to use graphs of electric power grids to generate polynomial rings with desired algebraic properties. In particular, we will classify the trees  $G$  for which  $I_G^P$  is Cohen-Macaulay and prove that every such ideal is also a complete intersection.

This is joint work with Michael Cowen, Alan Hahn, Todd Morra, and Sean Sather-Wagstaff.

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