



Gabe Wilfong is from Westfield, Indiana. He received his undergrad degree in Mechanical Engineering from Purdue University and immediately thereafter began his master's research with Dr. Lumkes. In 2011, Gabe graduated with an MS from ABE. He then worked for just over four years in industry, designing gearboxes at Fairfield Manufacturing. In the fall of 2015, Gabe left industry and returned to ABE to pursue a PhD in Dr. Lumkes' research group. Prior to graduation in May 2019, Gabe, his wife Leah, and his two girls joined with a group of about 30 adults from his church to permanently move to Athens, Georgia for the purpose of planting a new church. After moving down to his new home, he was able to secure a position as a high school teacher where he will be teaching robotics, computer science, and engineering.

# Agricultural & Biological ENGINEERING

## Dissertation Defense

**Speaker:** Gabriel Wilfong

**Title:** Modeling and analysis of ground-based autonomous agricultural vehicles

**Major Professor(s):** Dr. John Lumkes

**Date:** Thursday, July 18, 2019

**Time:** 2:00 pm

**Location:** LILY 2-425

### Abstract:

Autonomous agricultural vehicles (AAVs) have the potential to transform the way farming operations are completed. AAVs are a class of robotic machines that can complete agricultural tasks without requiring direct and constant control of a human operator. A simulation model was developed that calculates the energy requirements of AAVs operating on row crops. This deterministic model was used to quantify the energy needs and energy expenditures of agricultural vehicles and was further used to investigate the effects of using AAVs in lieu of conventional agricultural machinery. Crop production efficiency metrics were studied that provided an objective method of analyzing the advantages and disadvantages associated with replacing and/or augmenting conventional farming vehicles with AAVs. Finally, a modeling tool was developed in Microsoft Excel that allows a user to interact with the energy model in an intuitive way. Data sets can easily be created and modified for the purpose of evaluating different farming operations. Additionally, options within the VBA graphical user interface allow for parameter studies where multiple data sets can be instantly created in order to analyze the effects of changing a single variable.

### Application:

This project quantifies the requirements of robotic farming machines and introduces unique methods of using AAVs in the crop production process. This research will build the foundation for AAV design and allow for AAVs to be a major player in the effort to provide food for future generations.