HONORS PROJECT (Fall 2017–Spring 2018)

Senior Honors Program is a self-driven course for seniors at Albany Academy where a student learns about something not offered as a class at the school. The student uses their research to make a product for which they give an end of year presentation. Only a select group of applicants can participate in this course. My project was to make a prototype of a mechanically assisted knee device. I read multiple research papers about the kinematics of the leg while walking (an excerpt from the Army Research Lab paper on the kinematics of walking and running, which the main source of information, and some of my data reduction / analysis is shown on the next page). I used Autodesk Inventor to create a model of the frame and then used MATLAB to optimize the moment/torque of the knee. I built and tested multiple designs where I learn how to use an electric actuator, stepper motor, and brushless motor with esc (electronic speed control).

HONORS PROJECT (Fall 2017–Spring 2018)

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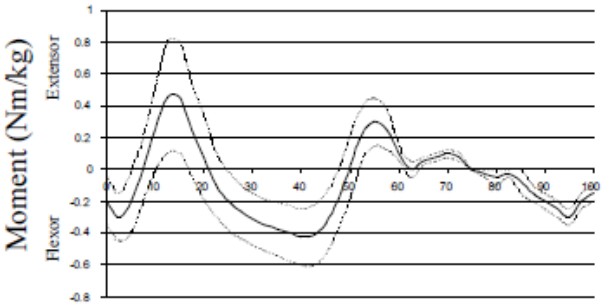
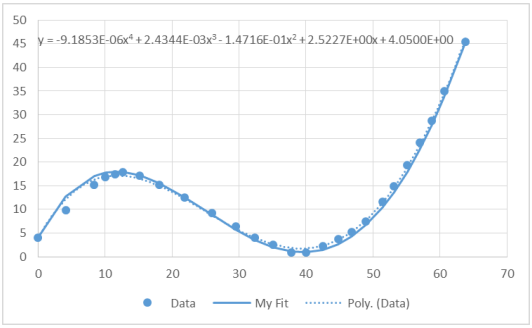
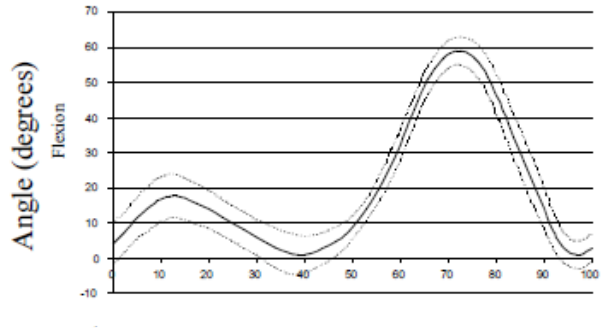
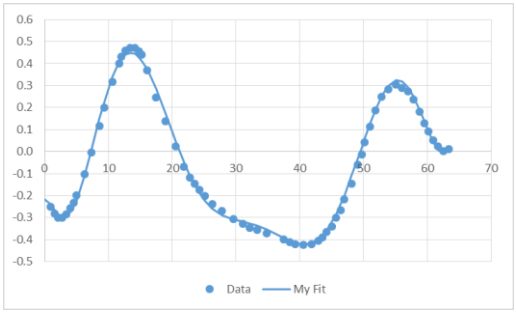
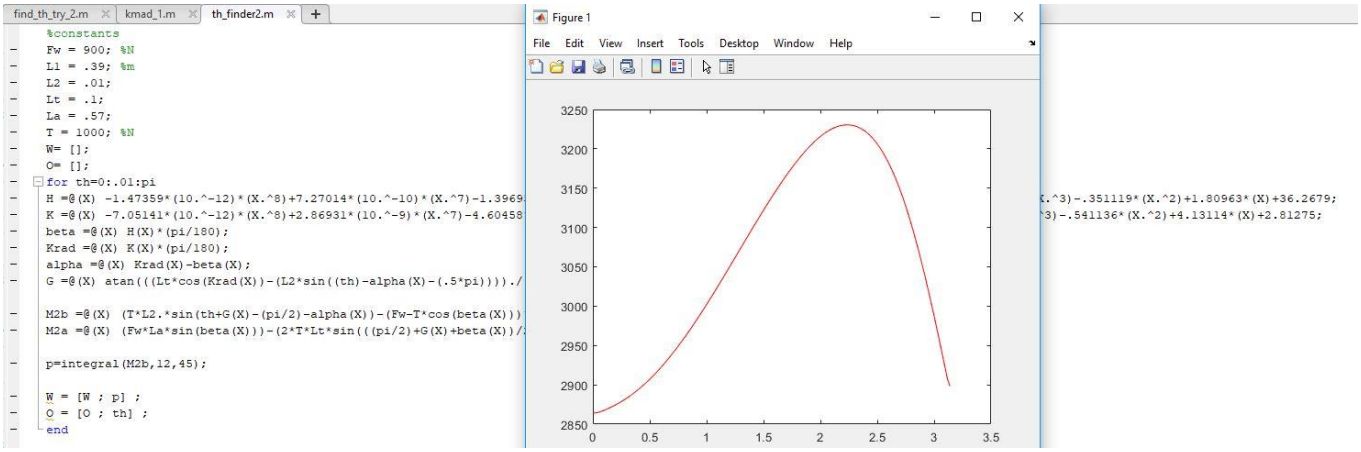




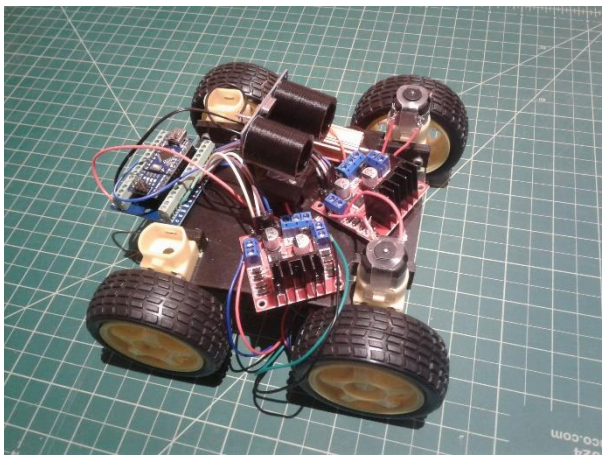






Mobile Arduino Based Scanning Robot (Spring 2019)

As an independent project I decided to learn more about robot solving process; therefore, I chose to design a semi-autonomous robot that could map out obstacles in its environment and plan a route around the obstacles. The robot uses an ultrasonic sensor to measure the distance of obstacle form itself, and uses a stepper motor to turn the ultrasonic sensor to measure the distance of objects from itself that aren't right in front of the robot. The robot uses two dual H bridge circuits, one to control the stepper motor another to control two DC motors which move the robot. The brains of the robot is an Arduino Nano (micro-controller). Multiple parts of the robot are 3D printed: the chassis, the blinders for the ultrasonic sensor to focus its range, and the mount for the ultrasonic sensor. The ultrasonic sensor mount was designed to keep the measuring point of the sensor in the center of the robot and not travel in an arc when the stepper motor is turning.



scaner_4 §

```
long duration;
long distance;
float cardist;
float x;
float y;
int a[4] = {1,2,3,4};
int n;
int i;

void setup() {
  Serial.begin(9600);
  pinMode(2,OUTPUT);  //stepper
  pinMode(3,OUTPUT);  //stepper
  pinMode(4,OUTPUT);  //stepper
  pinMode(5,OUTPUT);  //stepper
  pinMode(6,OUTPUT);  //us sensor
  pinMode(7,INPUT);   //us sensor
  pinMode(10,OUTPUT); //motor 1
  pinMode(11,OUTPUT); //motor 1
  pinMode(12,OUTPUT); //motor 2
  pinMode(13,OUTPUT); //motor 2
  /*delay(5000);
  scan();
  delay(20000);*/
  movecar(1);
}

void stp() {
   digitalWrite(2,LOW);
   digitalWrite(3,HIGH);
   digitalWrite(4,LOW);
```