Thesis Defense Document Plan-of-Action

* Objectives
  + Phase 1 – Phase 3
  + Description, and then breakdown of objectives, tasks, deliverables
* Revisit introduction and literature
  + Add additional literature that was discovered later on
  + Add relevant equations to the literature
  + Add information about waypoints and path planning
  + Add Dubin’s UAV section
  + Restructure GVF section to only include previous works
    - Gonc 3 papers
    - Wilhelm summer work
    - Identification of problems
      * No circulation to aid in circumnavigation
      * No method to determine VF parameters for optimized obstacle avoidance
      * No detection method for singularities when summing two fields
* Methodology
  + Tasks need performed (summary)
  + Path provided by path planner, guidance to stay on path by VF guidance system
  + Field construction
    - Straight path
    - Circular Path
    - Obstacle definition
    - Obstacle field
      * Field decay radius definition
      * TanH function
      * Repulsive and Circulation next to each other
  + Summing fields together
    - Summed field equations
    - Quiver of summed VF, not normalized
    - Singularity condition (Magnitude = 0)
      * Singularities expected to occur where the field has equal strength
      * Surface plot showing magnitude of vector field, confirming location by evaluating many points
      * Numerically determine location of singularities
      * Initial conditions placed on radius
      * Show singularity detection and how it matches with magnitude plot
  + Show Dubin’s UAV following repulsive only guidance
    - UAVs multiple velocities in an avoidance field
      * Demonstrate trap situations
      * Demonstrate poor obstacle tracking
      * Show singularities
  + Solving for circulation and decay radius R
    - Cost function (minimize deviation from path)
    - Obstacle radius r\_o = n\*theta\_r
    - R = k\*r\_o
    - Boundary conditions for solver
    - Step size
      * Min, max
    - Solution time
  + Show Dubin’s UAV following modified guidance with H and K solved
    - Path
    - Singularities
  + Notes on how fixed weight guidance limits how low the cost function can evaluate to
    - Dynamic weights, solving at each time step could produce better performance
* Simulations
  + Craziflie quad copter simulating fixed wing constraints
  + Setup
    - Vicon feedback
    - Roll, pitch, yaw, thrust PID control
    - Carrot chasing guidance with VF
      * Direction
      * Length
    - Guidance
      * MATLAB and Python validation
  + Scenarios
    - Centered
    - Off Centered
    - Large radius
  + Results
    - How all the algorithms evaluated
    - Comparison of algorithms
    - Plots
      * Update rate of controller
      * Update rate of guidance
      * Position with quiver plots
* Conclusions
  + Modified VF guidance with static weights optimized for obstacle avoidance investigated
  + Simulations performed
  + Programmed into python guidance and control system
  + Algorithm tested for several scenarios
  + Impact
  + Future work
    - Dynamic weights
    - Dynamic obstacles
    - Generalizing avoidance for obstacle along arbitrary path

Cost function, how it compares to other methods