Week 4 Summary Presentation

"Unified Path Following Guidance For Hybrid VTOLs"

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Goals for Week 4

1. Air-velocity reference vector based path following
2. Differences in control of multicopter / fixed-wing in Path-following
3. Different ramp-in/ramp-out function to derive air-velocity reference vector

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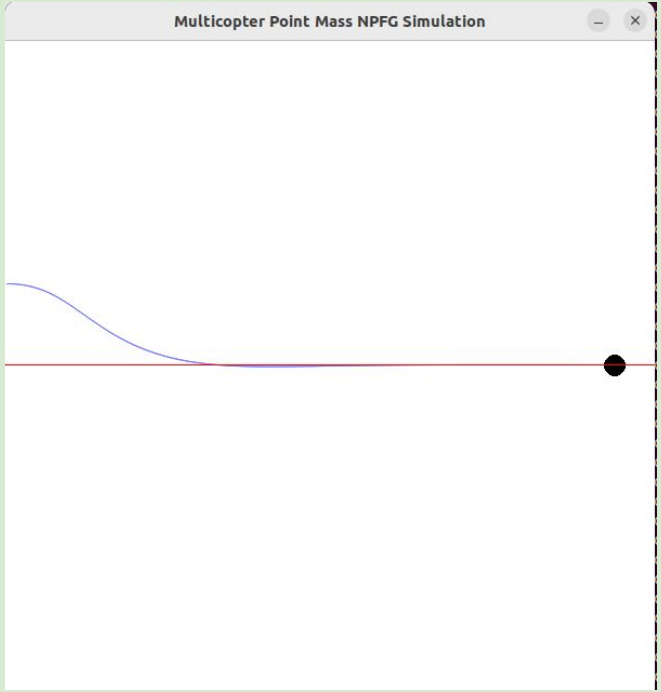
Multicopter Point-mass model



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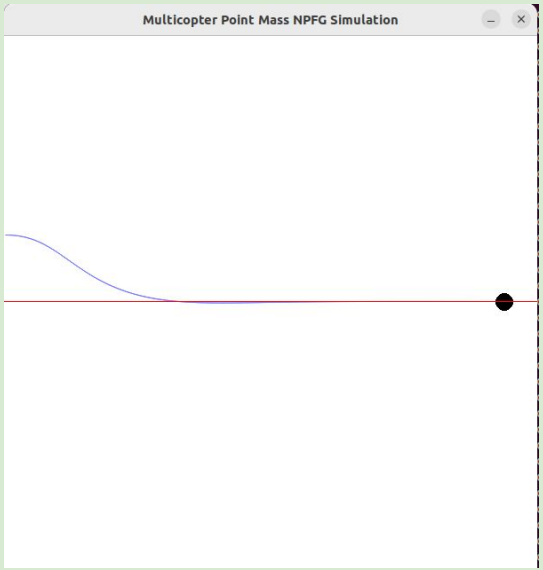
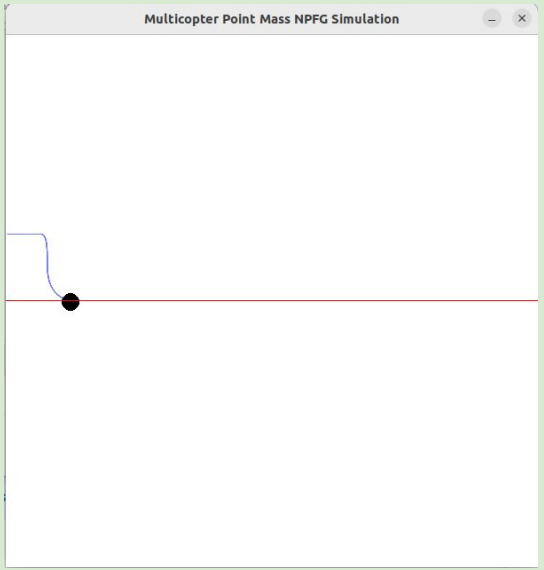
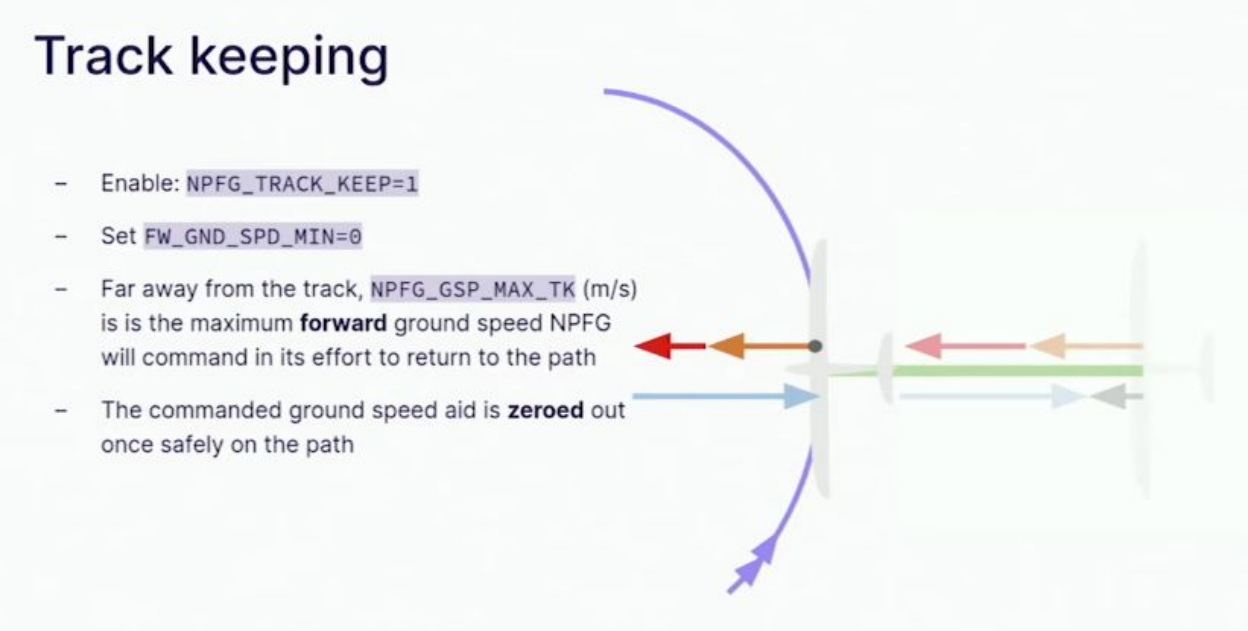
Track-keeping

User-set minimum ground speed = 5.0 m/s	User-set minimum ground speed = 0.0 m/s
	

Limitations of NPFG Track-keeping feature



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Limitations of NPFG Track-keeping feature

```
327  float NPFG::minGroundSpeed(const float normalized_track_error, const float feas)
328  {
329          // minimum ground speed demand from track keeping logic
330          min_gsp_track_keeping_ = 0.0f;
331
332          if (en_track_keeping_ && en_wind_excess_regulation_) {
333                  // zero out track keeping speed increment when bearing is feasible
334                  // maximum track keeping speed increment is applied until we are within
335                  // a user defined fraction of the normalized track error
336                  min_gsp_track_keeping_ = (1.0f - feas) * min_gsp_track_keeping_max_ * math::constrain(
337                                                   normalized_track_error / NTE_FRACTION, 0.0f,
338                                                   1.0f);
339          }
340
341          // minimum ground speed demand from minimum forward ground speed user setting
342          float min_gsp_desired = 0.0f;
343
344          if (en_min_ground_speed_ && en_wind_excess_regulation_) {
345                  min_gsp_desired = min_gsp_desired_;
346          }
347
348          return math::max(min_gsp_track_keeping_, min_gsp_desired);
349  } // minGroundSpeed
```

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Bearing Feasibility

Minimum Ground Speed = 1 - feasibility X Minimum Ground Speed Track-Keeping

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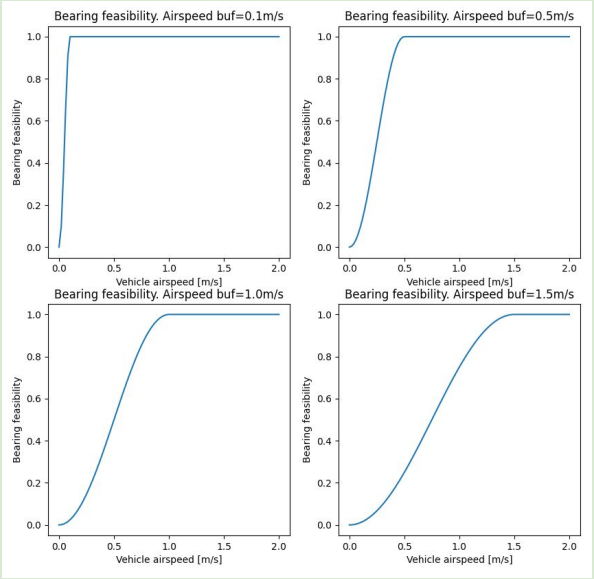

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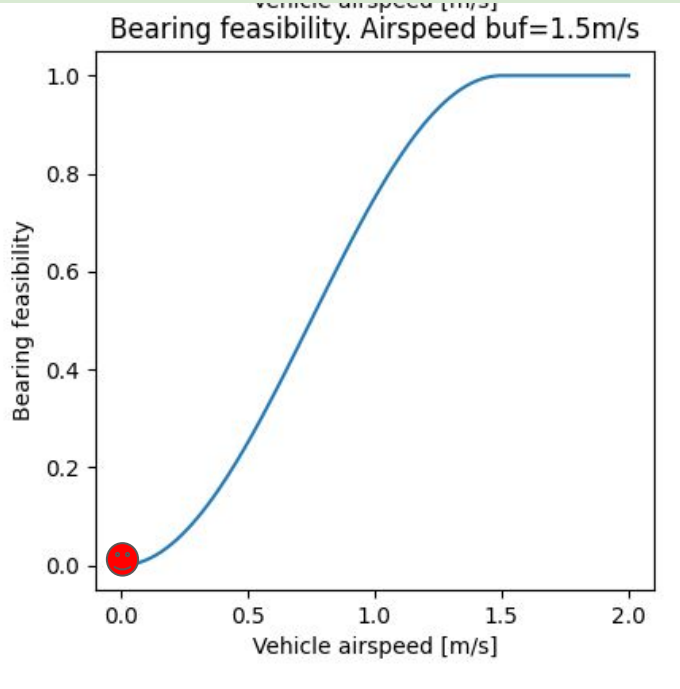
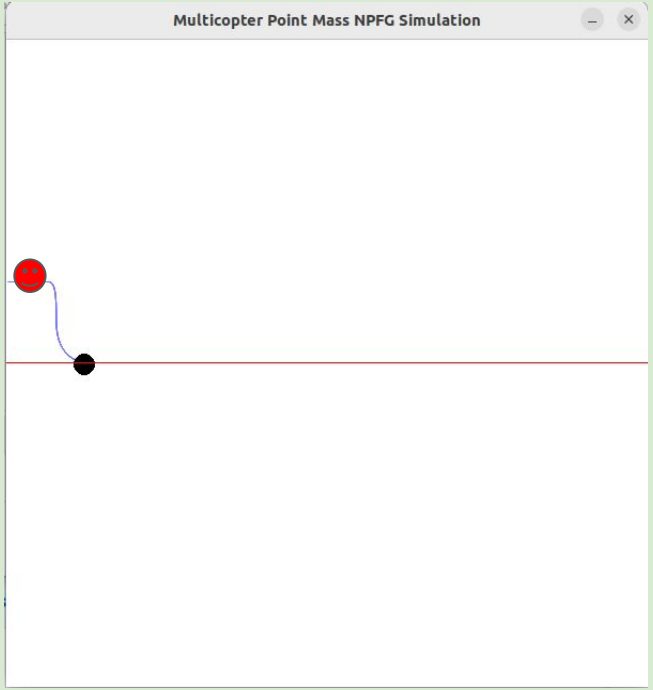
Bearing Feasibility





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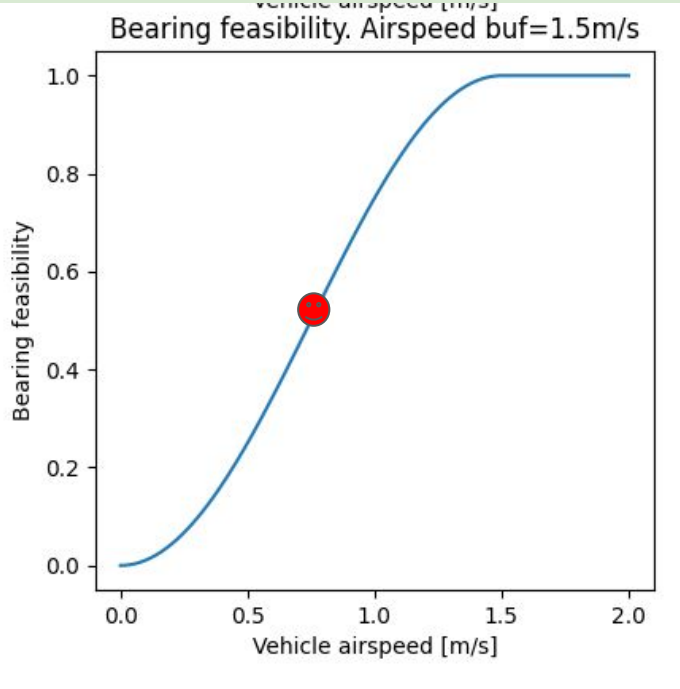
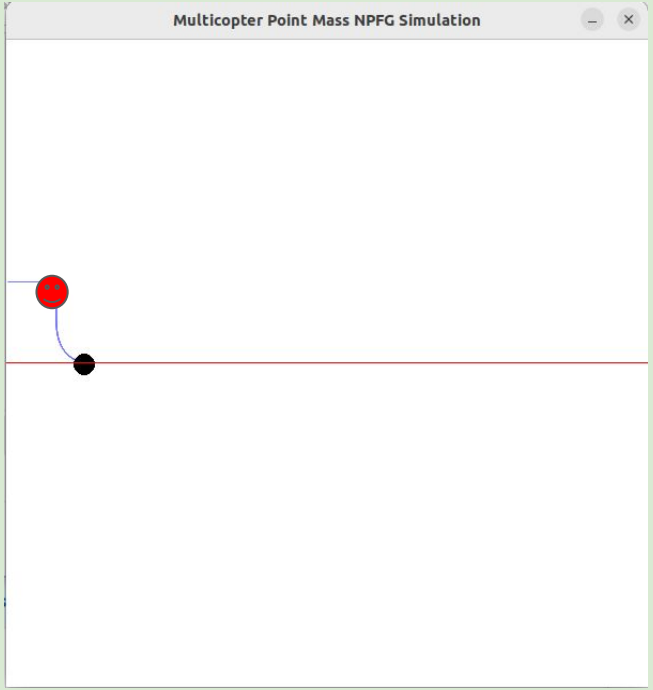
Bearing Feasibility





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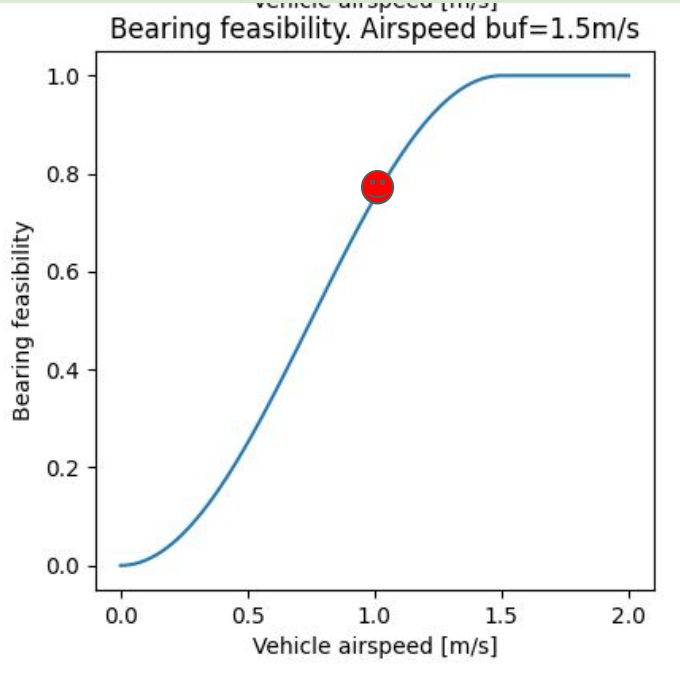

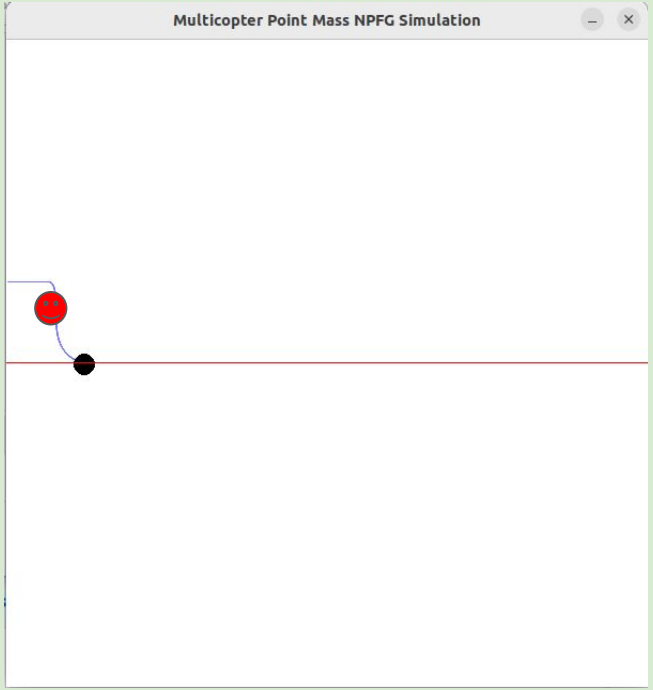

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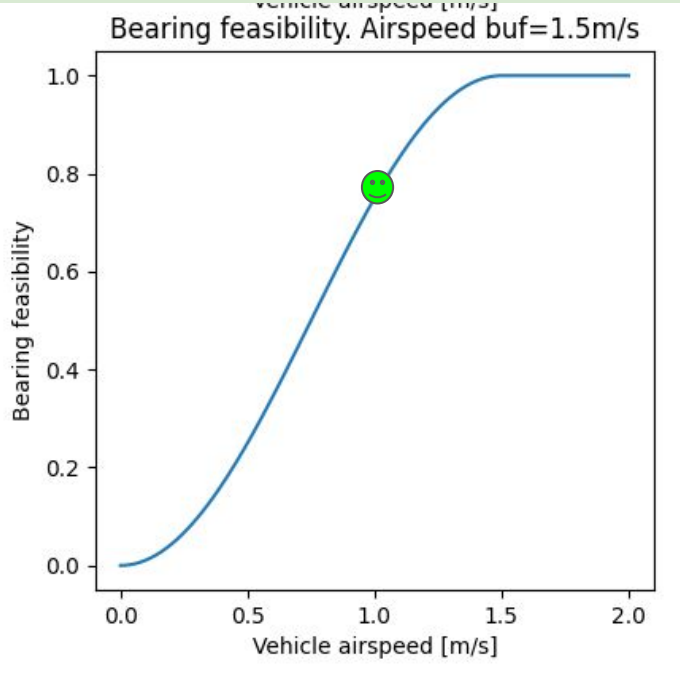

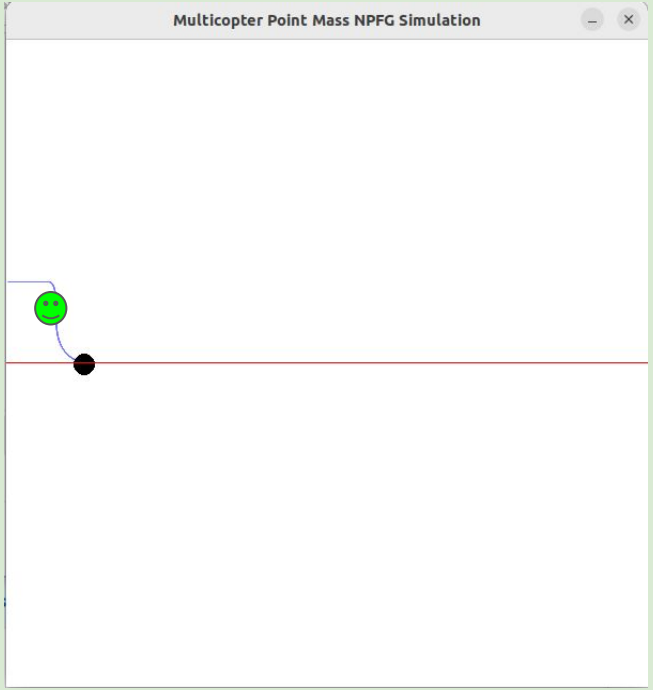

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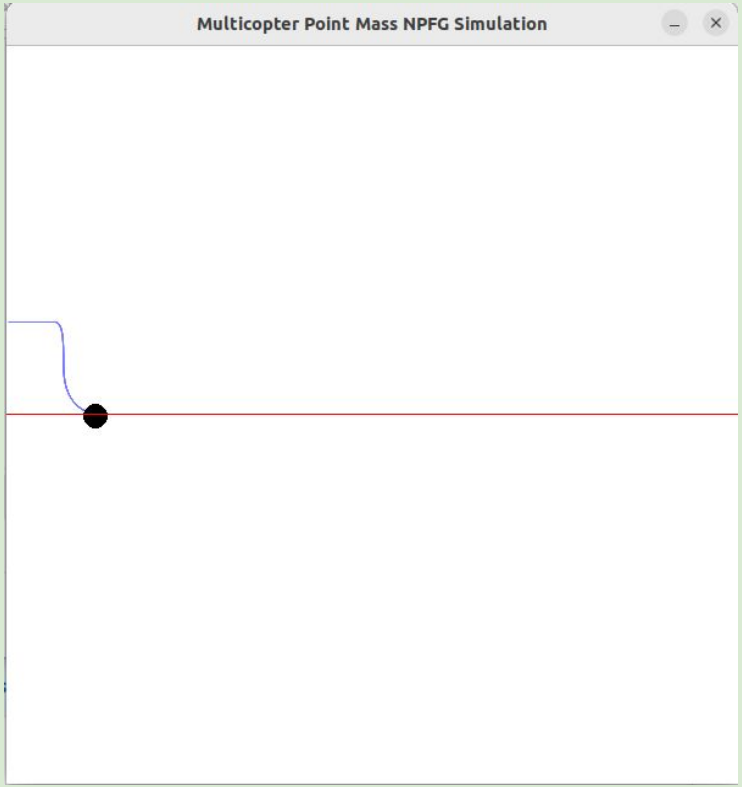
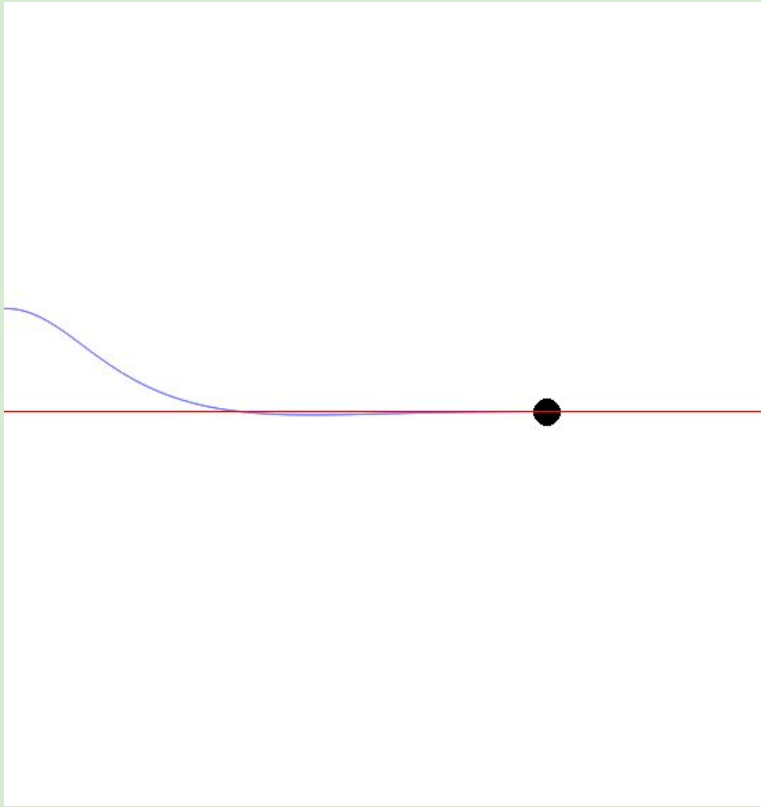
Multicopter vs Fixed-wing dynamics





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