Flight Test for System Identification

Portland State University

Maseeh College of Engineering & Computer Science

Department of Electrical & Computer Engineering

Author: Cam Osborn May 21, 2021

Tosting	To everying helpoviers in the lateral evis longitudinal evis and the vertical evis of the
Testing	To exercise behaviors in the lateral axis, longitudinal axis, and the vertical axis of the
Objective	RC F-16 by performing a frequency sweep on the elevator, aileron, and rudder. The
	following information will be collected.
	Ulog File from Qgroundcontrol
Technique	Take Off
	Perform racetrack pattern in steady state flight
	o Fly one Racetrack pattern with throttle at 40% to 60% to keep steady
	state flight
	 Measure the lengths of the parallel straightaways to achieve a 60 second
	straightaway flight
	 Exit first Racetrack pattern in steady state level flight to begin the second
	racetrack pattern
	Perform second racetrack pattern with Logarithmic Chirp
	 Begin first parallel straight in steady state level flight
	 Once the plane is in steady state level flight in the first parallel straight,
	the pilot should begin the frequency sweep by moving the deviating the
	elevator stick \pm 0.5–1.0 in. from the center, the pilot should slowly
	increase the oscillations positive and negative in intervals of 3, 6, 9, and
	12 seconds.
	 After the first frequency sweep return the flight to steady state level
	flight
	 The pilot should then perform a second frequency sweep of the aileron
	 After the second frequency sweep return the flight to steady state level
	flight
	 Complete racetrack turn
	 On the second parallel straight, the pilot should complete a frequency
	sweep of the rudder and return to steady state flight to complete the
	second racetrack turn and prepare for the third racetrack pattern
	Perform Third racetrack pattern with Doublet
	 Begin first parallel straight in steady state level flight
	 Five seconds into the parallel straight, the pilot should execute the
	doublet with a sharp input in the positive direction of the elevator until
	maximum angular rate is achieved, followed by the same input in the
	opposite direction
	 Return to steady state level flight
	 The pilot should then execute the doublet with a sharp input in the
	positive direction of the aileron until maximum angular rate is achieved,
	followed by the same input in the opposite direction
	 Complete the racetrack turn
	 Fifteen seconds into the second parallel straight, the pilot should execute
	the doublet with a sharp input in the positive direction of the rudder until
	maximum angular rate is achieved, followed by the same input in the
	opposite direction
	 Complete the second racetrack turn and prepare for landing
	Land

Required Tools	 Instrumented Plane with battery Radio Controller Armed PX4 Laptop Equipped with QGroundControl Pilot
Success	Pilot enters steady state level flight before and after each maneuver
Criteria	Pilot performs test with limited coupling of axes
	 Pilot does not collide the plane with the ground or other interferences in the
	airspace
Special	 Limited wind gusts
Considerations	Mostly clear weather
	 Does Safe Select Mode prohibit the frequency sweep?

Testing	To exercise behaviors in the lateral axis of the RC F-16 by performing a frequency
Objective	sweep on the elevator. The following information will be collected.
,	Ulog File from Qgroundcontrol
Technique	Take Off
rearrique	Perform first racetrack pattern in steady state flight
	Fly one Racetrack pattern with throttle at 40% to 60% to keep steady
	state flight
	 Measure the lengths of the parallel straightaways to achieve a 60 second
	straightaway flight
	 Exit first Racetrack pattern in steady state level flight to begin the second
	racetrack pattern
	Perform Second racetrack pattern with Logarithmic Chirp
	Begin first parallel straight in steady state level flight
	 Once the plane is in steady state level flight in the first parallel straight,
	the pilot should begin the frequency sweep by moving the deviating the
	elevator stick ± 0.5–1.0 in. from the center, the pilot should slowly
	increase the oscillations positive and negative in intervals of 3, 6, 9, and
	12 seconds.
	After the first frequency sweep return the flight to steady state level flight
	type o After the second frequency sweep return the flight to steady state level
	flight
	Complete racetrack turn On the second parallel straight, the pilot should complete the same two
	On the second parallel straight, the pilot should complete the same two
	frequency sweeps as before and return to steady state flight to complete
	the second racetrack turn and prepare for the third racetrack pattern
	Perform Third racetrack pattern with Doublet Dogin first parallel straight in steady state level flight
	Begin first parallel straight in steady state level flight Siften a considerable parallel straight, the milet should execute the
	Fifteen seconds into the parallel straight, the pilot should execute the
	doublet with a sharp input in the positive direction of the elevator until
	maximum angular rate is achieved, followed by the same input in the
	opposite direction
	Return to steady state level flight
	Complete the racetrack turn Cite on a second sixts the account graphed the cite the cite the country of the cite the cite the country of the cite th
	Fifteen seconds into the second parallel straight, the pilot should execute the doublet with a charmina with a positive direction of the players.
	the doublet with a sharp input in the positive direction of the elevator
	until maximum angular rate is achieved, followed by the same input in
	the opposite direction
	Complete the second racetrack turn and prepare for landing
	• Land
Dogwiel	a Instrumented Diene with better:
Required	Instrumented Plane with battery Padia Cartrallar Profile Ca
Tools	Radio Controller Armod DV4
	Armed PX4 Leaten Fruit and with OCroundControl
	Laptop Equipped with QGroundControl Plant Pl
	Pilot

Success	 Pilot enters steady state level flight before and after each maneuver
Criteria	 Pilot performs test with limited coupling of axes
	Pilot does not collide the plane with the ground or other interferences in the
	airspace
Special	Limited wind gusts
Considerations	Mostly clear weather
	 Does Safe Select Mode prohibit the frequency sweep?

Testing	To exercise behaviors in the longitudinal axis of the RC F-16 by performing a
Objective	frequency sweep on the Aileron. The following information will be collected.
,	Ulog File from Qgroundcontrol
Technique	Take Off
recinique	Perform first racetrack pattern in steady state flight
	Fly one Racetrack pattern with throttle at 40% to 60% to keep steady
	state flight
	 Measure the lengths of the parallel straightaways to achieve a 60 second
	straightaway flight
	 Exit first Racetrack pattern in steady state level flight to begin the second
	racetrack pattern
	Perform Second racetrack pattern with Logarithmic Chirp
	Begin first parallel straight in steady state level flight
	 Once the plane is in steady state level flight in the first parallel straight,
	the pilot should begin the frequency sweep by moving the deviating the
	aileron stick $\pm 0.5-1.0$ in. from the center, the pilot should slowly increase
	the oscillations positive and negative in intervals of 3, 6, 9, and 12
	seconds.
	 After the first frequency sweep return the flight to steady state level
	flight
	 The pilot should then perform a second frequency sweep of the same
	type
	 After the second frequency sweep return the flight to steady state level
	flight
	Complete racetrack turn
	 On the second parallel straight, the pilot should complete the same two
	frequency sweeps as before and return to steady state flight to complete
	the second racetrack turn and prepare for the third racetrack pattern
	Perform Third racetrack pattern with Doublet
	 Begin first parallel straight in steady state level flight
	 Fifteen seconds into the parallel straight, the pilot should execute the
	doublet with a sharp input in the positive direction of the aileron until
	maximum angular rate is achieved, followed by the same input in the
	opposite direction
	 Return to steady state level flight
	 Complete the racetrack turn
	 Fifteen seconds into the second parallel straight, the pilot should execute
	the doublet with a sharp input in the positive direction of the aileron until
	maximum angular rate is achieved, followed by the same input in the
	opposite direction
	 Complete the second racetrack turn and prepare for landing
	• Land
Required	Instrumented Plane with battery
Tools	Radio Controller
	Armed PX4
	Laptop Equipped with QGroundControl
	• Pilot
L	

Success Criteria	 Pilot enters steady state level flight before and after each maneuver Pilot performs test with limited coupling of axes Pilot does not collide the plane with the ground or other interferences in the airspace
Special	Limited wind gusts
Considerations	Mostly clear weather
	 Does Safe Select Mode prohibit the frequency sweep?

Testing	To exercise behaviors in the vertical axis of the RC F-16 by performing a frequency
Objective	sweep on the Rudder. The following information will be collected.
,	Ulog File from Qgroundcontrol
Technique	Take Off
'	Perform first racetrack pattern in steady state flight
	 Fly one Racetrack pattern with throttle at 40% to 60% to keep steady
	state flight
	 Measure the lengths of the parallel straightaways to achieve a 60 second
	straightaway flight
	 Exit first Racetrack pattern in steady state level flight to begin the second
	racetrack pattern
	Perform Second racetrack pattern with Logarithmic Chirp
	Begin first parallel straight in steady state level flight
	 Once the plane is in steady state level flight in the first parallel straight,
	the pilot should begin the frequency sweep by moving the deviating the
	rudder stick $\pm 0.5-1.0$ in. from the center, the pilot should slowly increase
	the oscillations positive and negative in intervals of 3, 6, 9, and 12
	seconds.
	 After the first frequency sweep return the flight to steady state level
	flight
	 The pilot should then perform a second frequency sweep of the same
	type
	 After the second frequency sweep return the flight to steady state level
	flight
	Complete racetrack turn
	 On the second parallel straight, the pilot should complete the same two
	frequency sweeps as before and return to steady state flight to complete
	the second racetrack turn and prepare for the third racetrack pattern
	Perform Third racetrack pattern with Doublet
	Begin first parallel straight in steady state level flight
	 Fifteen seconds into the parallel straight, the pilot should execute the
	doublet with a sharp input in the positive direction of the rudder until
	maximum angular rate is achieved, followed by the same input in the
	opposite direction
	Return to steady state level flight
	Complete the racetrack turn
	 Fifteen seconds into the second parallel straight, the pilot should execute
	the doublet with a sharp input in the positive direction of the rudder until
	maximum angular rate is achieved, followed by the same input in the
	opposite direction
	Complete the second racetrack turn and prepare for landing
	Land
	Land
Required	Instrumented Plane with battery
Tools	Radio Controller
10015	Armed PX4
	Laptop Equipped with QGroundControl
	Pilot
	▼ FIIUL

Success	 Pilot enters steady state level flight before and after each maneuver
Criteria	 Pilot performs test with limited coupling of axes
	 Pilot does not collide the plane with the ground or other interferences in the
	airspace
Special	Limited wind gusts
Considerations	Mostly clear weather
	 Does Safe Select Mode prohibit the frequency sweep?