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MATLAB PROJECT 2

Preliminary Study

Aluminum Wing	*units*	*Cruise*	*PHAA*	*PLAA*	*NHAA*	*NLAA*
Stringer (#1) Area (minimum)	($inch^2$)	0.60	0.60	0.60	0.60	0.60
Stringer (#2) Area (minimum)	($inch^2$)	0.60	0.60	0.60	0.60	0.60
Stringer (#3) Area (minimum)	($inch^2$)	0.60	0.60	0.60	0.60	0.60
Stringer (#4) Area (minimum)	($inch^2$)	0.60	0.60	0.60	0.60	0.60
MS - stringer (minimum)		-0.61	-0.90	-0.90	-0.74	-0.74
MS - skin (minimum)		3.52	0.13	0.01	1.74	0.63
Tip vertical displacement	(inch)	26.98	102.52	102.52	-40.47	-40.47
Tip twist	(degree)	0.01	-0.55	0.06	0.29	0.90
Thickness	(inch)	0.05	0.05	0.05	0.05	0.05
Minimum Aluminum Wing Weight	(lb)	185.44	-	-	-	-

Carbon/Epoxy Wing	*units*	*Cruise*	*PHAA*	*PLAA*	*NHAA*	*NLAA*
Stringer (#1) Area (minimum)	($inch^2$)	0.60	0.60	0.60	0.60	0.60
Stringer (#2) Area (minimum)	($inch^2$)	0.60	0.60	0.60	0.60	0.60
Stringer (#3) Area (minimum)	($inch^2$)	0.60	0.60	0.60	0.60	0.60
Stringer (#4) Area (minimum)	($inch^2$)	0.60	0.60	0.60	0.60	0.60
MS - stringer (minimum)		1.29	-0.40	1.87	0.53	0.53
MS - skin (minimum)		12.74	2.48	2.09	7.48	4.08
Tip vertical displacement	(inch)	11.82	44.92	44.92	-17.73	-17.73
Tip twist	(degree)	0.01	-0.32	0.06	0.17	0.55
Thickness	(inch)	0.05	0.05	0.05	0.05	0.05
Minimum Carbon/Epoxy Wing Weight	(lb)	103.84	-	-	-	-

Design Study

Aluminum Wing	*units*	*Cruise*	*PHAA*	*PLAA*	*NHAA*	*NLAA*
Stringer (#1) Area (minimum)	(inch2)	5.05	5.05	5.05	5.05	5.05
Stringer (#2) Area (minimum)	(inch2)	5.05	5.05	5.05	5.05	5.05

Stringer (#3) Area (minimum)	(inch2)	5.05	5.05	5.05	5.05	5.05
Stringer (#4) Area (minimum)	(inch2)	5.05	5.05	5.05	5.05	5.05
MS - stringer (minimum)		2.88	0.02	2.96	1.59	1.59
MS - skin (minimum)		5.05	0.44	0.34	2.49	0.99
Tip vertical displacement	(inch)	2.66	10.12	10.12	-4.00	-4.00
Tip twist	(degree)	-0.04	-0.67	-0.13	0.32	0.86
Thickness	(inch)	0.0575	0.0575	0.0575	0.0575	0.0575
Minimum Aluminum Wing Weight	(lb)	652.74	-	-	-	-

Carbon/Epoxy Wing	*units*	*Cruise*	*PHAA*	*PLAA*	*NHAA*	*NLAA*
Stringer (#1) Area (minimum)	(inch2)	1.05	1.05	1.05	1.05	1.05
Stringer (#2) Area (minimum)	(inch2)	1.05	1.05	1.05	1.05	1.05
Stringer (#3) Area (minimum)	(inch2)	1.05	1.05	1.05	1.05	1.05
Stringer (#4) Area (minimum)	(inch2)	1.05	1.05	1.05	1.05	1.05
MS - stringer (minimum)		2.99	0.05	4.03	1.66	1.66
MS - skin (minimum)		4.32	0.35	0.20	2.30	0.98
Tip vertical displacement	(inch)	6.80	25.82	25.82	-10.19	-10.19
Tip twist	(degree)	0.03	-0.81	0.17	0.43	1.41
Thickness	(inch)	0.0195	0.0195	0.0195	0.0195	0.0195
Minimum Carbon/Epoxy Wing Weight	(lb)	86.56	-	-	-	-

The carbon/epoxy wing was able to have significantly smaller string areas and skin thickness than the aluminum wing. This resulted in the final wing weight of the composite wing being almost a quarter of that of the aluminum wing.