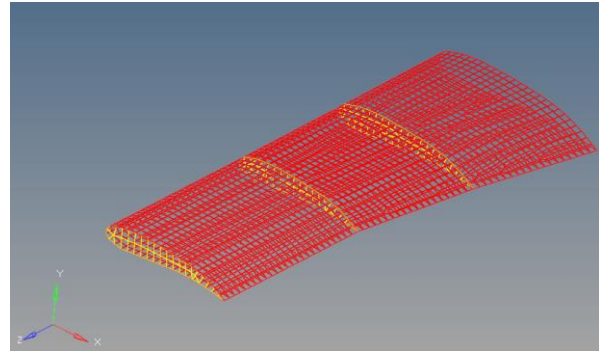
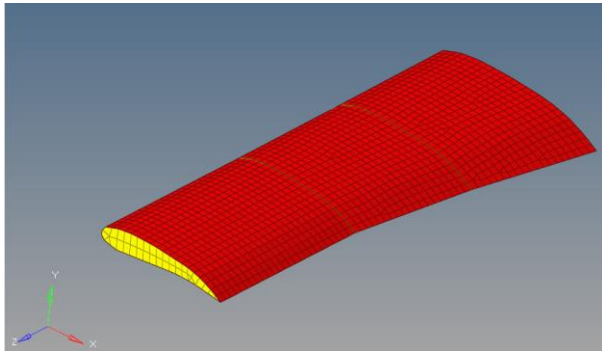


Example: Wing Linear Buckling Analysis

This exercise runs a linear buckling analysis on a simple aircraft wing. This is a typical problem for aerospace structures that need to be very light and consequently become slender. Because the structure has a high slenderness ratio, the buckling failure verification becomes necessary. The objective of this project is to verify if the 3 static load cases applied to the wing will not make it fail.

In this exercise, you will learn how to verify a wing baseline design for buckling criteria.



Design criteria:

Buckling: first mode > (1.5 x).

(Static: $U < 20$ mm and Von Mises < 70 MPa)

Material Aluminum:

$\rho = 2.1e-9$ T/mm³ [RHO] Density

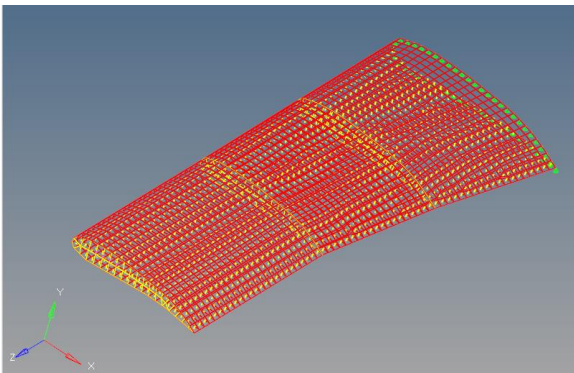
$E = 70,000$ MPa [E] Young's Modulus

$\nu = 0.33$ [nu] Poisson's ratio

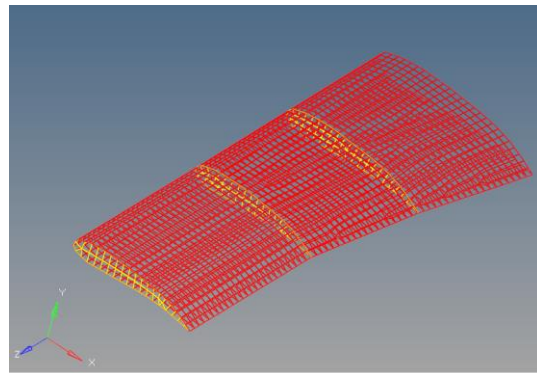
In the given model (Wing.hm), the load, the constraints and loadcases have already been created. Please review the property, material and load collectors before starting the baseline analysis.

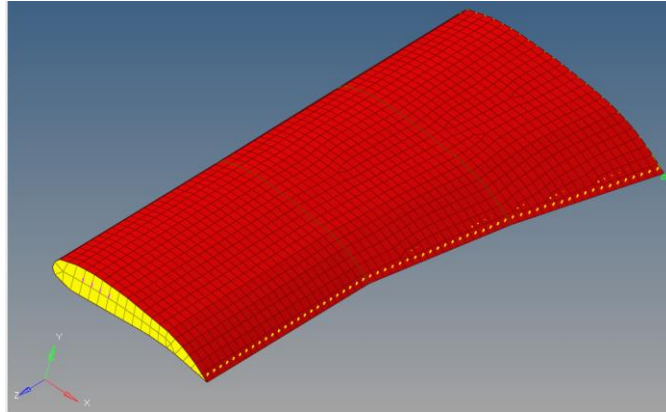
Here, we focus on the load collectors:

Load Collectors (4)			
constraints	1	0	0
pressure	2	0	0
tip_load	3	0	0
SUM	4	0	0



C





In the load collector named **SUM** (with card image **LOAD**), the loads from the load collectors **Pressure** (ID=2) and **tip_load** (ID=3) are combined. S, S1(1) and S1(2) are weighting factors, respectively.

LOADADD	ID	S	S1(1)	L1(1)	S1(2)	L1(2)
	4	1.0000	1.0000	2	1.0000	3

User Comments
 Hide In Menu/Export
 LOAD_Num_Set= 2

reject
default
abort
return

The three static load steps are:

Load Steps (3)		
PRESSURE	1	0
TIP	2	0
SUM	3	0

name = PRESSURE type: linear static

SPC = 1 STATSUB(PRELOAD)
 LOAD = 2 PRETENSION
 MPC STATSUB(PRETENS)
 SUPPORT1
 DEFORM

next prev create edit update review return

name = TIP type: linear static

SPC = 1 STATSUB(PRELOAD)
 LOAD = 3 PRETENSION
 MPC STATSUB(PRETENS)
 SUPPORT1
 DEFORM

next prev create edit update review return

name = SUM type: linear static

SPC = 1 STATSUB(PRELOAD)
 LOAD = 4 PRETENSION
 MPC STATSUB(PRETENS)
 SUPPORT1
 DEFORM

next prev create edit update review return

Note, the analysis **type** is set to **linear static**, respectively

In order to define the buckling load step, another load collector is needed. Do you recall what the missing load collector is about?

We need to create a load collector with Card Image **EIGRL** (to define the number of buckling modes we are interested in)

Its Card Image is:

E I G R L	SID	[V1]	[V2]	[ND]	[MSGVLV]	[MAXSET]	[SHFSCL]	NORM
	5			2				MASS

Load Collectors (5)		
constraints	1	0
pressure	2	0
tip_load	3	0
SUM	4	0
EIGRL	5	0

With respect to loadsteps of interest

Load Steps (3)		
PRESSURE	1	0
TIP	2	0
SUM	3	0

We define the buckling loadstep next

Please compare the ID's of the referenced load collector (**SPC=** and **METHOD=**) and loadstep (**STATUSB=**)

name =	buck_pressur		type:	linear buckling	create
<input checked="" type="checkbox"/> SPC	=	1	<input type="checkbox"/> STATUSB(PRELOAD)		edit
<input type="checkbox"/> MPC					update
<input checked="" type="checkbox"/> METHOD(STRUCT)	=	5			review
<input checked="" type="checkbox"/> STATUSB(BUCKLING)	=	1			
<input type="checkbox"/> DEFORM					return

name =	buck_tip		type:	linear buckling	create
<input checked="" type="checkbox"/> SPC	=	1	<input type="checkbox"/> STATUSB(PRELOAD)		edit
<input type="checkbox"/> MPC					update
<input checked="" type="checkbox"/> METHOD(STRUCT)	=	5			review
<input checked="" type="checkbox"/> STATUSB(BUCKLING)	=	2			
<input type="checkbox"/> DEFORM					return

name =	buck_sum		type:	linear buckling	create
<input checked="" type="checkbox"/> SPC	=	1	<input type="checkbox"/> STATUSB(PRELOAD)		edit
<input type="checkbox"/> MPC					update
<input checked="" type="checkbox"/> METHOD(STRUCT)	=	5			review
<input checked="" type="checkbox"/> STATUSB(BUCKLING)	=	3			
<input type="checkbox"/> DEFORM					return

Finally run the analysis and view the buckling modes.

