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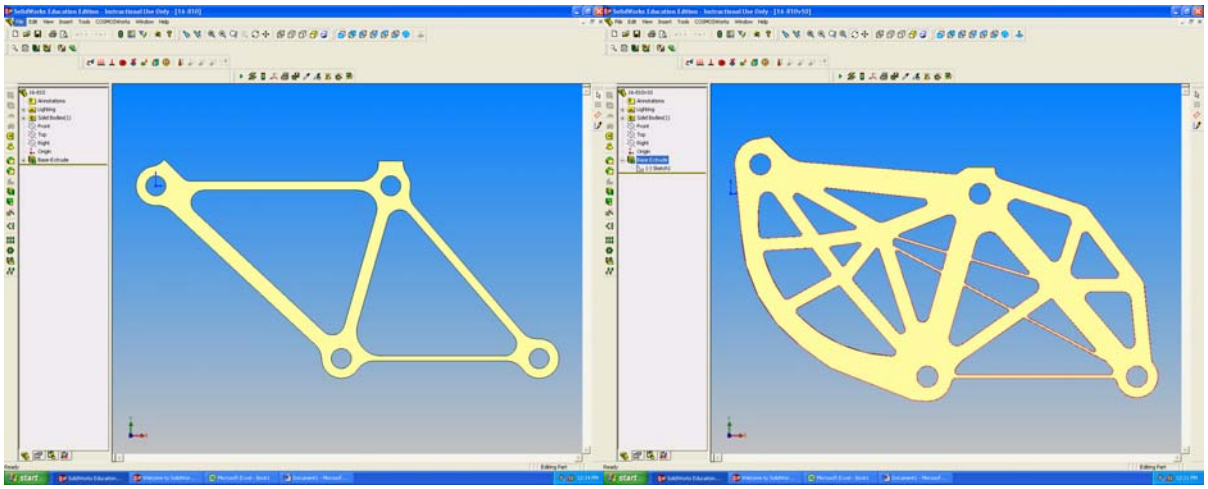
ACROBATIC BIKE

Jan 28, 2004
16.810 – IAP

Second Version of Acrobatic Bike: Changes, Iterations, and Results:

The changes from the first version to the second version can be summarized as adding more truss-like elements to the design. We went from a 5-member truss design to a 32-member design. Screen shots of the different models can be viewed below.



Version 1 Version 2 (Iteration 12)

The changes of our FEA results throughout each iteration can be seen below:

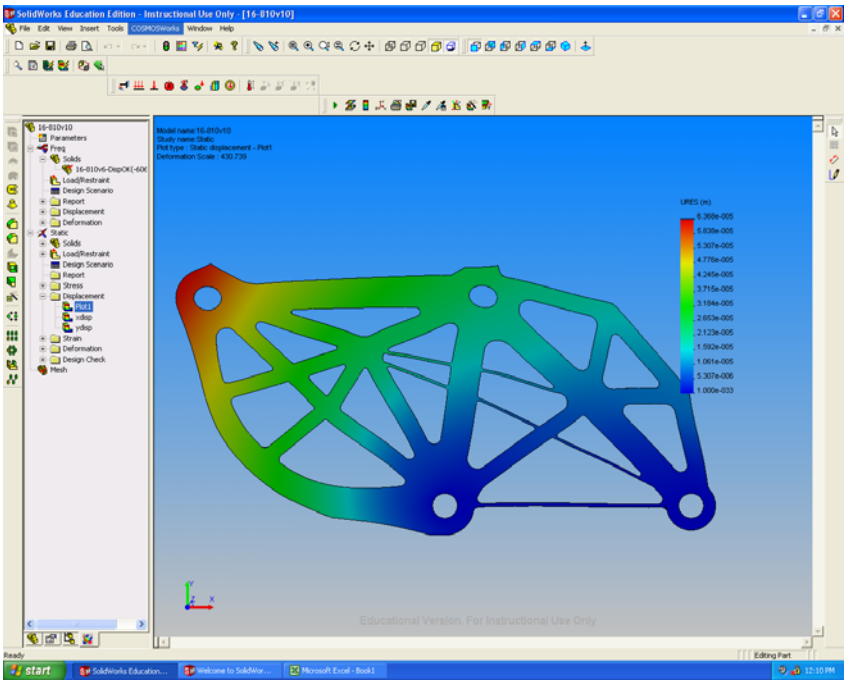
Version.Iteration	Mass (kg)	Disp 1 (mm)	Disp 2 (mm)	Freq (Hz)	No. of Members	Cost
Orig. Req	***0.07273***	***0.06300***	***0.01000***	***632.20***		***$10.14***
1	0.06350	0.22500	0.01510	424.39	5	$6.99
2.2	0.09310	0.15500	0.00618	458.25	10	YTBD
2.3	0.10300	0.11980	0.01050	535.62	16	YTBD
2.6	0.15240	0.06530	0.00833	545.50	15	YTBD
2.7	0.16770	0.06700	0.00905	555.06	14	YTBD
2.8	0.18414	0.05320	0.00636	551.24	23	YTBD
2.9	0.18260	0.05490	0.00733	571.99	24	YTBD
2.10	0.18323	0.05410	0.00735	578.35	27	YTBD
2.11	0.18200	0.05400	0.00690	586.16	32	YTBD
2.12	0.17660	0.05690	0.00715	581.50	32	YTBD
Modified Req.	***0.18182***	***0.06300***	***0.01000***	***632.20***		***Unlimited***

As can be seen, Version 2, Iteration 12 meets the mass and displacement requirements. However it falls short by 8% (or 50.70 Hz) of the minimum first mode frequency. We would like to have a relaxation of this requirement, if possible, in order for this part to have meet all the modified requirements.

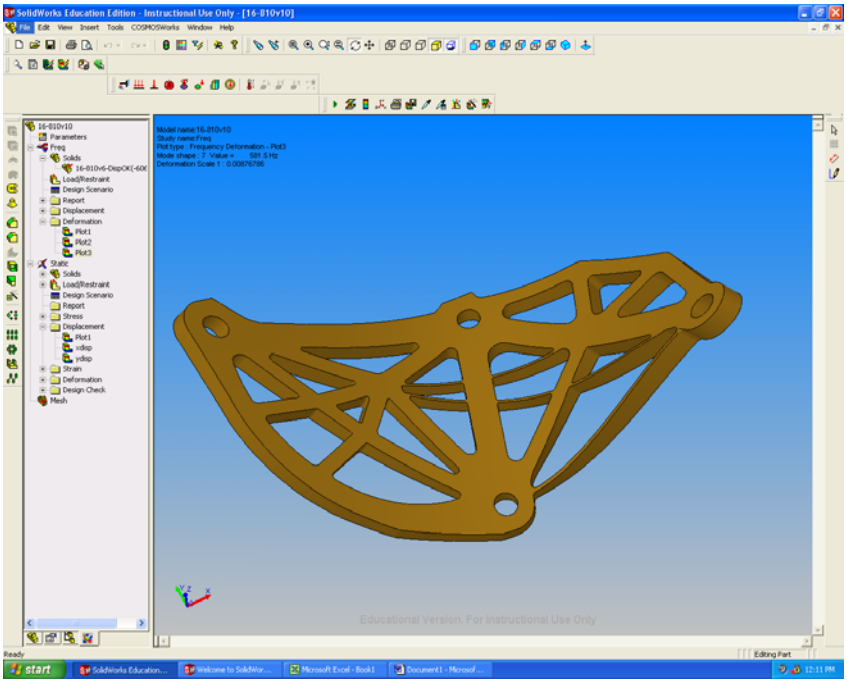
Allowed relaxations of requirements were given for mass and cost. We have an unlimited cost requirement now, and a 0.40 lb mass requirement (formerly 0.16 lb).

Finite Element Analysis:

Below are screen shots of the Finite Element Analysis completed for Version 2, Iteration 12.



Displacement Analysis



Frequency Analysis