Subject: Snap Fit Cantilever question
Posted by msandoe on Sat, 11 Aug 2012 09:21:23 GMT
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So, I'm a raising sophomore in Mechanical Engineering, and I haven't taken my Deforms class yet. I was hoping that one of the smart people on this forum might be able to help me out with that?

I'm trying to make a case be able to slide into a cavity, and then lock in place upon reaching the end of the cavity, and then have the user be able to easily unlatch that case and pull it back out to access the contents of said case. I'm thinking my best bet is to have a cantilever hook attached to the case that will latch on to a small notch.

What I need to know is, How wide, thick, and long should I make the Beam of the cantilever and What angles and dimensions should I give the hook to ensure that
1) the beam and/or hook won't snap off,
2) the cantilever hook is still flexible enough to allow the user to unlatch it
3) the case will stay locked when the hook is latched

I'm using the Strong and Flexible Plastic.

I'm pretty sure that what you need to know about the material to solve this problem is here:
http://www.shapeways.com/rrstatic/material_docs/mds-strongfl ex.pdf

I just don't know how to use that information

ANY rule of thumb thoughts would also be totally appreciated!

File Attachments

1) Dimensions of notch and beam.jpg, downloaded 173 times
2) Dimensions of the hook.jpg, downloaded 135 times
3) tray goes through the back and cantilever goes through hole to the knotch.jpg, downloaded 126 times

Subject: Re: Snap Fit Cantilever question
Posted by msandoe on Wed, 15 Aug 2012 20:02:18 GMT
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First, I hate to draw attention to myself by spamming my own thread, but I'm hungry for an answer.

Common-sense-wise, is the strong and flexible plastic basically so strong and flexible that I shouldn't be worrying about this? or should I limit the beam length to at most a certain dimension at this thickness? I read this

http://www2.basf.us//PLASTICSWEB/displayanyfile?id=0901a5e18 01499d5

which was posted earlier on the forum about cantilever's, but it kind of requires someone with a little bit of an understanding of deforms to use what it says, i think. I just need a rule-of-thumb answer!

Subject: Re: Snap Fit Cantilever question
Posted by BillBedford on Wed, 15 Aug 2012 22:26:44 GMT
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.. or maybe it requires you to have a partly working example in front of you to decide how it can be improved.

Subject: Re: Snap Fit Cantilever question
Posted by msandoe on Wed, 15 Aug 2012 22:44:13 GMT
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Upon further inspection, I've concluded I haven't given enough context. The .stl files are attached xP

just in case we're foggy on what I was explaining in the first post:

- I want to be able to insert Phone Wallet Tray.stl into Phone Wallet base2.stl ,

- having the cantilever hook on the Phone Wallet Tray.stl go through the hole in Phone Wallet base2.stl into the other compartment of Phone Wallet base2.stl

- there it will snap into a little indent in the wall of that compartment.

-then the cantilever hook should be flexible enough to allow the user to take it out of the indent.

That's the most explicit way I can describe what I'm doing, I think. I hope the .stl's are helpful.

File Attachments
1) Phone Wallet Tray.stl, downloaded 82 times
2) Phone Wallet base2.stl, downloaded 76 times

Subject: Re: Snap Fit Cantilever question
Posted by wiwa on Mon, 20 Aug 2012 18:34:26 GMT
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Hi Msandoe
I took a look at your model under FEA to evaluate the snap fit. I am not sure what scale you intended so I picked inches (total width approximately 7 inches)

Your snap fit won't have a problem going in as designed. The displacement available to the snap fit is > 4mm total without reaching yield (image 1).

However I would be concerned if this is going to be forced out against the snap fit - it will be more difficult to remove and forcing it out may cause it to fail.

The best bet, in general, is to try the design and re-evaluate based on functional testing.
WiWa

File Attachments
1) Phone Wallet Tray.JPG, downloaded 569 times

Subject: Re: Snap Fit Cantilever question
Posted by msandoe on Mon, 20 Aug 2012 20:20:42 GMT
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Thanks for the reply wiwa!

Oops, the max dimension on this case is supposed to be 5.5 inches. Anyhow, as a student, I apparently get to use Autodesk Inventor free of charge and it has it's own stress analysis function (possibly not the same as Finite Element Analysis, but pretty close I'd think) It wants to know what material I'm using for this, but there's no option for PA 2200 or Polyamide :/ what's a plastic that would be a good substitute so that whatever works with that material should almost definitely work with the Strong and Flexible Plastic? The list of Materials has various Polystyrenes, Polycarbonates, Polypropylene, Polyethylene, ABS Plastic, PET plastic, and PVC.

Also, what do I want to look out for with this Stress testing? What are the indicators of when the

cantilever will fail? Here's a pic of what I've been able to do (stress test1.jpg)
I can see the Von Mises, 1st Principal, and 3rd Principal Stresses as well as the Displacement when I place a load of .1 lb (sensible?) on the end of it.

Lastly, Why is getting the Snap-fit out so much more difficult than getting it in?

Also, I know trial and error is a good thing for this sort of stuff... but I don't wanna xP at least not for $60

File Attachments

1) stress test1.jpg, downloaded 443 times

Subject: Re: Snap Fit Cantilever question
Posted by wiwa on Mon, 20 Aug 2012 20:33:30 GMT
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PA 2200 is a bit unique but you can use these material properties to approximate it:

Yield Strength 48 MPa (48e6 N/m^2)
Elastic Modulus 1.7 GPa (1.7e9 N/m^2)
Poisson's 0.35
Density 960 kg/m^3

Instead of applying a force where you did, you should apply a displacement equivalent to the displacement the snap fit will experience during insertion. Then if the stresses observed are greater than the Yield Strength you can expect it to break on insertion. I am not sure how to apply a direct displacement in Inventor - in Solidworks it is under Advanced Fixed Geometry.

To simulate removal you can place a force going away from the body of the piece on the tip snap hook. That would simulate the removal of the hook. If a reasonable force of ~10 lb causes the hook to displace enough to be removed, without stressing beyond the yield stress, then it can be forcefully removed without breaking.
