
Subject: Ball joints and other moving parts
Posted by [Drawn-SteelHero](#) on Thu, 01 Jul 2010 00:30:28 GMT
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I'm currently working on my first 3D-printable project, which is a small (about 2.5-3" at the longest dimension) multi-part action figure. By the looks of it, it will consist of about 25 moving parts, and for most of these I intend to use WSF to make snap-in hinges and ball joints.

Most of the model is worked out barring surface detailing and a bit of hollowing to conserve materials. But I need to check on the tolerances of the material so I can make sure I've left enough clearance on the joints.

Is there enough flex in WSF to allow a ball slightly larger than the entrance hole (say, and extra 0.5-1mm) to pop in? I'd add a slot in the back of the socket to allow air to escape as the ball goes in. And does anybody know how much clearance I'd need to make around the ball to allow it to fit snugly but still move when rotated? I've seen people mention leaving 0.5mm around moving parts that will be printed in situ, but this will probably be assembled post-printing, so I'd assume the clearance wouldn't need to be quite that high.

Andy

Subject: Re: Ball joints and other moving parts
Posted by [virtox](#) on Thu, 01 Jul 2010 09:54:20 GMT
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There is plenty of flex in WSF
Make sure to keep the wall thickness > 0.7mm.
Preferably double in the "working/bending" parts.

For a post-print snap joint I would not use any extra clearance.

In my experience negative spaces (socket) tend to be every so slightly smaller by 0.1-0.2mm. And positive spaces (ball) 0.1-0.2 mm bigger.

So chances are it will work as it should, if you make the ball the same size as the socket.

If you add some extra material, I would not go as high as 1 mm, that would be very tight I think. Stay under 0.5 mm perhaps.

But a lot depends on the actual design (and probably print orientation, over which we have no real control), so best is probably to test-print a few joints. Preferably with multiple orientations in one

file, to make sure it works regardless of print direction.

Cheers,

Stijn

Subject: Re: Ball joints and other moving parts
Posted by [Drawn-SteelHero](#) on Thu, 01 Jul 2010 10:45:25 GMT
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Thanks for the input! In case I wasn't clear, when I referred to "extra material" on the socket I was referring to making the entrance to the socket slightly narrower than the main ball and socket themselves; that way the ball pops in and the socket entrance holds it in place. But as you mentioned, I shouldn't need the diameter more than half a millimetre smaller to do the job. I'm aware of the 0.7mm minimum, and I'm trying to keep the walls as thick as I can - although that's proving to be a challenge in some places, given the size of the figure and all the parts-inside-parts action!

I'm certainly not making my first print a simple one..!

Andy

Subject: Re: Ball joints and other moving parts
Posted by [virtox](#) on Thu, 01 Jul 2010 11:21:04 GMT
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Ah sorry I missed the "entrance" part

As long as the entrance is not "solid" but more like bendable notches, you should probably make the entrance smaller by at least 1 mm

For example this design :

http://www.shapeways.com/model/35009/ball_joint_v1.html

worked except I did add a little clearance, which made the joint too loose.

Subject: Re: Ball joints and other moving parts
Posted by [bartv](#) on Thu, 01 Jul 2010 13:30:40 GMT
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Virtox: that's model is not 'public', so we can't see it.

Bart

Subject: Re: Ball joints and other moving parts
Posted by [virtox](#) on Thu, 01 Jul 2010 13:37:56 GMT
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Actually, it's not ...

It says "Available to all" "Show Only"..

(i see in a different browser what you mean, weird it's shows the size and all, but no pictures...)

Flipping some options saving it works again. Let me guess, caching

Subject: Re: Ball joints and other moving parts
Posted by [bartv](#) on Thu, 01 Jul 2010 13:39:32 GMT
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Ok, there's something odd going on. Yes, I can access the model's page but all the images on it say 'This model is no longer publicly available' when I'm logged in. When I'm not, it's ok. I'll ask our IT guys.

Bart

Subject: Re: Ball joints and other moving parts
Posted by [Youknowwho4eva](#) on Thu, 01 Jul 2010 13:44:03 GMT
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Seems to be working now. I know sometimes if you hit save and change pages too quick you get weird results.

Subject: Re: Ball joints and other moving parts
Posted by [Drawn-SteelHero](#) on Thu, 01 Jul 2010 13:54:51 GMT
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Actually, while I got the "not publically available" message too, I found I could still use the 3D viewer for it, so it was still helpful.

Don't you think a "solid" lip would have enough flexibility, then? Most of the balls will only be between 2 and 4mm in diameter, so I doubt I'd want more than a half millimetre reduction for the entrance lip anyway.

I love your ball joint design. If you don't mind my borrowing it, something like the socket to that could prove very useful on the larger joints, like the hips; it looks like it would have the extra benefit of reduce how much material I'd need, too.

I think I'd need to stick with a more traditional joint for the smaller knees and ankles, though.

Andy

Subject: Re: Ball joints and other moving parts
Posted by [virtox](#) on Thu, 01 Jul 2010 14:06:57 GMT
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With solid lip, you mean like pushing a bigger ball through a donut ?
If you could get it in there without breaking the WSF, it might get to loose too quickly due to wear.

Your welcome to use the ball joint design. I've thickened the whole by 0.1 mm, so it should be tighter and sturdier now.

But this design was primarily focussed on "cheapness" so for heavy duty use, the "stilt" and "lips" would need some reinforcement.

http://www.shapeways.com/model/133448/balljoint_v2.html

Attached is the STL (mm) file for reference.

You're welcome to use it, but in the case you get (filthy) rich with it, I expect to benefit also

Cheers !

File Attachments

1) [Balljoint V2.stl](#), downloaded 111 times

Subject: Re: Ball joints and other moving parts
Posted by [Youknowwho4eva](#) on Thu, 01 Jul 2010 14:41:46 GMT
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You could always go stainless http://www.shapeways.com/forum/index.php?t=msg&goto=11708&S=c9d5c28bbacb1a20c7d889c4c7acab11&srch=stainless+ joint#msg_11708

Subject: Re: Ball joints and other moving parts
Posted by [Drawn-SteelHero](#) on Thu, 01 Jul 2010 17:27:20 GMT
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virtox wrote on Thu, 01 July 2010 14:06 With solid lip, you mean like pushing a bigger ball through a donut ?

If you could get it in there without breaking the WSF, it might get to loose too quickly due to wear. I suppose the doughnut analogy sort of works, yeah. The idea being that the lip has just enough give to let the ball past with a little force. Once it's on, you have to pull the pieces apart, they won't just fall off. And while I can see how it might loosen if you popped them on and off all the time, I wouldn't have thought doing it once or twice (basically to assemble the parts) would weaken it that much, if at all. I guess that's something I'll only know for sure once I get an actual printout in hand.

But I have a ton of toys with ball joints working on exactly the same principle, so I see no reason why it wouldn't work.

Youknowwho4eva wrote on Thu, 01 July 2010 14:41 You could always go stainless
I actually briefly considered steel for a few parts, but I'll probably want to dye most of them, plus I imagine the steel would get expensive very quickly.

Subject: Re: Ball joints and other moving parts
Posted by [Youknowwho4eva](#) on Thu, 01 Jul 2010 17:36:57 GMT
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This version would cost me \$1.70 a piece but it's untested. the tested version cost \$3.40. So depending on the size of your model it could get expensive, but as long as you stick to the limits of stainless, it's not too bad. Even this one I could probably trim off another 10 cents or so.

http://www.shapeways.com/model/111362/smaller_test.html

Subject: Re: Ball joints and other moving parts

Posted by [Drawn-SteelHero](#) on Thu, 01 Jul 2010 17:53:26 GMT
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Well, I did a really, really rough calculation based on boundary dimensions, and if I do it all in WSF, it'll probably cost me somewhere in the region of \$30, though I think (and hope) I was deliberately overestimating there, since I'm removing as much interior material as I can.

Subject: Re: Ball joints and other moving parts
Posted by [Drawn-SteelHero](#) on Sun, 04 Jul 2010 21:27:18 GMT
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Well, I just finished cleaning up and uploading my model, so I thought I'd post it here. I want to wait till I'm able to get a test print before I release it for sale, but I'm pleasantly surprised at the price - basic cost of the SWF is less than \$19, so once I actually have some money I'll be test-printing that and possibly the Black Detail version too.

<http://www.shapeways.com/model/134144/despoiler.html>
