Subject: Re: Direct Drive Revisited
Posted by Wayne Parham on Tue, 20 Jul 2004 05:15:30 GMT
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Where's the motorcycle forum? That sounds cool! Your old flathead sounds cool too! That's a WWII era bike, isn't it? Maybe just before?About turntables, the point I want to make is that I don't think either drive type is inherently superior and that both have strengths and weaknesses. I think the belt drive can take advantage of pulley ratios but has to overcome the fact that the drive motor has mechanical contact with the needle through the platter and belt. The direct drive has advantage that it can made to have complete isolation between motor and cartridge but it has less torque and no pulley leverage. Each issue can be dealt with, and so I guess the engineer has different issues to concern himself with depending on the basic design type chosen. But since turntables have become less popular, there are fewer engineers working on them.If I were planning to do a new turntable design project, I would ask for support from a mechanical engineer to quantify some of the torque and speed issues and what not. But just shooting from the seat of the pants, here are some of my thoughts.On the low end, under $1K turntables, I've been very happy both with my Rega P2 belt drive table and a couple of old Technics direct drive tables. One of my old Technics had a speed control and no servo feedback. It was completely open loop. The other kept constant speed, and so did have a feedback loop, which means it was interpolating or "hunting" to regulate speed. But to be honest, I was happy with each of them, and while I like the Rega the best, I think a lot of it is because it's my newest one and I got it from a great guy, David Cope at Triode & Co. But I was also very happy with my old Technics direct drive table with the manual speed control and the Audio Technica AT20SL cartridge. That was a real nice sounding turntable too.On the high end, I can only do a thought experiment because I don't know of any truly high end direct drive tables. And like I said, if we're making a statement product and willing to spend $20K, I'm pretty sure that we'll do a really great job with our turntable either way we go. We've all seen some stunning belt drive tables for $20K. Beautiful craftsmanship and high quality components.So but lets look at what we might do if we were going to make a money-is-no-object direct drive turntable. We can put these ideas in the wishbox and throw it over to the mechanical engineers to make it happen. Since we're comparing drive types, let's not consider the tone arm and cartridge right now. If we were really building this thing, that would be a pretty big part of the deal but for the purpose of comparing drive types, I think we can put that aside for a moment.If I were making a price-no-object turntable, I'd have both platter and base machined from a solid block. Make 'em heavy and make 'em attractive too. There are many suitable materials, I'm sure. But I would want them to be heavy and the platter would also need some area that could be machined for balancing and for embedding motor components.The thing I'd place most focus on would be the suspension, both for the platter and for the base. I would want the platter to be suspended completely without contact. No spindle, no bearings, no shaft, no contact whatsoever. I'd look into pneumatic or magnetic levitation or other means to hold it in place without requiring physical contact with the base. With a $20K budget, I think that could be done, particularly if I had quantities of a small production run to spread development costs on. If not, then perhaps a more traditional platter mount could be investigated. But the point is that I'd want to isolate the platter as much as possible, with complete isolation the goal. Isolating the base from the mounting surface would be the next step, and it would be important too.As for motor drive, I would want initial starting torque from one mechanism, like a start winding and capacitor. But this would cut out and leave only the main motor. This wouldn't require much torque, as it is only needed to maintain speed of a high mass platter on a nearly frictionless axis.

The majority of the speed regulation would be done by virtue of the fact that the platter is massive and very little torque is applied. So it would be a mass/momentum regulated system. I don't know if I would investigate any sort of feedback system or leave it open loop, but the regulation would be largely provided by the fact that there was very little torque compared to mass. Any speed changes would happen extremely slowly, whther they be accelerations or decelerations. In fact, there may be a brake that should be added for shutdown. Maybe a clutch style brake should be used so the thing didn't spin for a lengthy time after the turntable is shut off.The point is that the design goal of complete isolation between needle and motor (and base) is possible with a direct drive, but it is not possible with a belt drive turntable. A belt drive table can take advantage of platter mass, and it has an additional advantage of pulley ratio to reduce motor speed fluxuations. But a massive load in this case will tend to flex the belt and might make it wear prematurely. Even if the belt is a long wear item, it is still something that must be maintained and will eventually break. So there are some things that make a really nice direct drive implementation very attractive.Still, belt drive has been the preferred technology of high-end tables. It's inherent strengths have obviously been pushed to the Nth degree. I never meant to say that I thought a five hundred dollar commercial direct drive turntable from the 70's would outperform a $20K belt drive turntable made today. I just think that there are some advantages to direct drive tables too, and that a high end design that exploited them might really be great.