Subject: Distortion
Posted by Sloan on Tue, 18 Nov 2008 21:38:04 GMT
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I have been thinking about distortion in tubes verses transistors. I thought transistors distorted less than tubes but what was there was higher orders. This would be OK in most cases but when it gets high enough to hear it is really bad because high orders are so much more objectionable than low orders. Even though tubes have higher distortion it is lower orders so it isn't so bad.Then a friend told me something that floored me and I am looking for more information regarding this. I was told that transistors often distort more than tubes and it isn't the part but the feedback that makes the difference. What I mean is the reason transistor amps distort less isn't the transistors at all but instead its the fact that so much negative feedback is used. This cancels the distortion at least in theory. The problem is it can't work in all situations like when the amplifier nears clipping. The feedback loops can no longer work because there is no gain left. This can happen under other situations too like a fluxuating load.If that's true it brings everything into a new light. If you take a 3 watt SET amplifier and compare it with a 3 watt bipolar transistor amplifier both running class A but one triode and the other solid state, will the tube amplifier distort less? Of course the tube and transistor have to be suitably rated for this power level, one can't be driven too hard and the other not for a fair comparison. What do you think? Is my friend right?

Subject: Re: Distortion
Posted by beun on Mon, 27 Jul 2009 00:30:29 GMT
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Basically he is partly right. All tubes, MosFets and bipolars distort on their own. The big difference is that tubes and Fets are primarily second order devices while bipolar transistors are exponential devices. So in a tube or Fet amplifier without (much) feedback the distortion components are mostly even (2nd, 4th) while in a bipolar amplifier it will be primarily odd (3rd, 5th, etc).

Additionally the exponentional bipolar device will produce more of the higher order odd components that a tube will of the lower order even components. This means that in any amplifier you need feedback to reduce the distortion. Let me put this a bit stronger, all amplifiers use feedback even the ones that say they don't. They may not use global feedback but they will have local feedback (also called degeneration).

Since transistors usually have more available bandwidth than tubes you can trade that with global feedback against distortion. The bandwidth of the amplifier will go down (that's Ok, since you had too much of that anyway)while the distortion will go way down.

As you already mentioned there is a difference in clipping behavior. Strong global feedback will keep the distortion great right until the end when you start to clip hard. An amplifier with low or no heavy global feedback (most tube amps) will clip a lot more slowly which may sound better to the ear. In my opinion though when you operate close to clipping you need a more powerfull amp.

Also the design is more important than the components used, a tube amp with heavy negative

feedback will function like a classical transistor design while a transistor amp with low global feedback can mimic the classical tube design.