AURAL SENSITIVITY TO POLARITY

I suspect that Dr Lipshitz (October Letters) and I are getting round to dealing with apparent misunderstandings rather than real differences of opinion on the question of polarity maintenance.

The polarity effects that Dr Lipshitz described do exist and have been known to exist for some 30 years and I discussed the generally accepted explanation. The waveforms of speech are known to be asymmetrical and either by coincidence or evolution the asymmetry just about compensates for asymmetry of the opposite polarity in the ear drum system. To maintain the compensation that nature apparently intended, it is necessary that our radio transmission systems maintain this polarity relation, a positive going sound pressure wave at the studio microphone producing a positive going sound pressure wave in the listening room. Polarity changes anywhere in the system will produce a change in the quality of the reproduced sound. However, the effect is subtle and I think that it requires equipment of professional quality if it is to be detectable.

I think Dr Lipshitz will agree that the experiments that he describes only tend to support this explanation.

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ADVANCED PRE-AMPLIFIER DESIGN

I found Mr Jung's letter in the September issue most interesting; it is gratifying to encounter someone who constructs and measures the circuit under discussion before commenting on it. However, I think it is important to distinguish clearly between the two types of restriction of output swing that occur at high frequencies in the type of disc pre-amplifier being discussed. It is, I think, better to stick with the accepted nomenclature and reserve the term "slew limiting" for that effect arising from the open-loop behaviour of an amplifier, and caused by finite currents charging and discharging compensation capacitance.

The other form of output restriction, which Mr Jung deals with under the same heading, is rather different, being peculiar to closed-loop amplifiers with significant shunt capacitance in the feedback arm. This is of course precisely the situation that occurs in an RIAA equalised input stage where the gain is designed to be relatively low so that a high overload margin may be obtained (assuming that a gain control of some kind is then placed before any further voltage gain). The core of the problem is that the feedback-loop shunt capacitance falls in reactance as the frequency being handled increases, and so an increasing current demand is placed on the output section of the amplifier; if this cannot be satisfied then a form of clipping results, and the output capability (and hence the input overload performance) is restricted at the top of the audio spectrum.

The output structure of the disc input stage of the "Advanced pre-amplifier" is a simple emitter-follower; this is much better at sourcing current than sinking it, and so Mr Jung's graph shows a curtailment of output capability at full drive and high frequencies, indicated by the abrupt rise of harmonic distortion that is typical of clipping. Examination will show that deformation of the output waveform only takes place on the downward half-cycle, due to the limited current-sinking capability, and in this respect the effect is quite different from what is normally known as slew-limiting.

It is at this point important to note that "full drive" is some 40dB above the nominal operating level of the stage, so the effects discussed here are unlikely to be obtrusive in the day-to-day performance of the preamplifier. Mr Jung's graph shows that if the test signal amplitude is reduced by 12dB there are no output-restriction effects in the audio band.

Finally, I have tested the effect of Mr Jung's modification (reduction of R_e to 1kΩ), and while the graph he displays is certainly correct in its essentials*, I feel it would be more meaningful to plot maximum available output swing against frequency. If this is done, it will be seen that the modification has its maximum effect at about 6kHz, where another 3.2dB of output voltage is available, giving a corresponding increase in input overload margin. However, the improvement diminishes either side of this frequency, falling to 1.0dB at 1kHz and to 2.4dB at 10kHz. Readers must judge for themselves whether this is worth the extra 14mA drawn from the power supply; confirmed lily-gilders may care to note that the same improvement can be implemented without increase in the current drawn by replacing R_e with a constant-current source delivering 6mA.

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*The distortion figures shown for below 3kHz seem rather high — in particular it is most suspicious that the t.h.d. at 1kHz is shown as being higher at 1.25Vr.m.s. than at 5Vr.m.s. I assume that the data shown includes the imperfections of the test equipment.

CEE22 MAINS CONNECTORS STANDARD OR FIASCO?

Do manufacturers of electrical equipment using the CEE22 mechanical size and shape connector have any requirement to use a particular pin configuration? Many of the mains leads for these equipments (if not the majority) are of the moulded variety, and consumers tend to implicitly trust these leads.

Although it is becoming less common, single pole switching is still in use and production. The danger lies in the fact that while the equipment is switched off or when the mains fuse is blown the internal circuit is still live if the live and neutral leads are reversed. God forbid the results if the earth lead is transposed!

To date I have found three different manufacturers issuing equipment with live/neutral transposed leads. Two of these put no names on the leads.

I hope more people can be made aware of the moulded lead quality control/non-standard hazard.

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ELIMINATING ADJACENT-CHANNEL INTERFERENCE

I find the July 1977 issue article on eliminating adjacent channel interference by P. L. Taylor to be most interesting. I have been attacking the problem for some time and have also developed a system to attenuate in-band interference on double sideband transmissions. This has been demonstrated to operate well with in-band modulated carriers and numerous in-band tones. Noise is also reduced. However, I have been unable as yet to satisfactorily eliminate cross modulation between noise and the wanted signal, and, of course, depending on how noise theory is interpreted and extended, this may or may not be possible.

As the system is somewhat complex this is not the place for its description. However, I find the reactions that I have been receiving to it to be surprising and rather depressing, and unfortunately some of these reactions would also apply to Mr Taylor's design.

The first reaction from Canadian Government officials is that interference and noise do not pose any problem as current equipment provide noise-free reliable links. Next, the system only applies to double sideband transmissions. This form of radio communication is now obsolete and is being legislated out of existence to be replaced by single sideband. A reaction from Canadian industry is that it is too complex to warrant risking development money and would necessitate synchronous receiver operation which has proved unpopular in the past. From Canadian universities and research establishments comes the comment that the system cannot possibly work for noise because Shannon set the God-given limits twenty years ago and any suggestion that his theory can be developed to show more than 3dB advantage for double over single sideband transmission is rank heresy; common interference reduction is of no interest. Incidentally, the one exception here is McMaster University in Hamilton, Ontario.

Double sideband amplitude modulation produces a unique signal having a "mirror image" frequency spectrum and constant phase. Interference can be detected in very much the same way as used to be employed in old movies for a man to tell whether or not he was real. If he saw his reflection in a mirror he was real, if no reflection was there he had to conclude that he was a ghost.

There is the possibility that a double sideband signal can be lifted out of interference and noise to an extent that is an order of magnitude greater than current communications theory implies. It is not that the theory is wrong, it is that it is limited. Mr Taylor's system shows one approach, my own shows another.

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