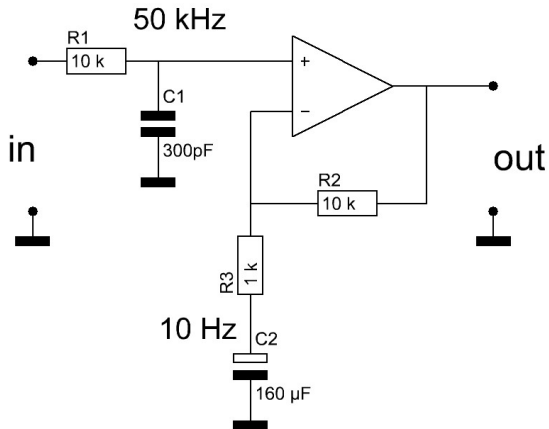


Servo's in Amplifiers

Preface

With the most power amplifiers the amplification is limited from 10 Hz to, say, 50 kHz. A simple RC low pass filter circuit at the entrance (R1 and C1) takes care of the 50 kHz⁺ and an 'elco' (C2 with R3) in the feedback serves the 10 Hz⁻. For the C2-solution the dubious word 'servo' is used. C2 in the feedback circuit attenuates the amplification of the low frequencies to 1.

C1 could well be a mica capacitor and C2 practically must be an electrolytic capacitor!



Be aware that the DC voltage on this 'elco' is zero and it is connected to the most sensitive point in the circuit: the reactance from 10 Hz on should be very small regarding $R3 = 1000 \Omega$, at least its reactance must be stable!

I designed two power amps: the SSA35 and the SSA120 (see this site) with nearly the same circuit diagram. However the SSA35 sounded better than the SSA120. See: 'Vergelijking van SSA120 met SSA35' in Dutch. The outcome was that C2 in the SSA120 had to be short circuited to approach the sound of the SSA35. Apparently the elco (C2) in the SSA35 'was better' than that in the SSA120..... Eventually I short circuited C2 in the SSA35 as well.

The function of C2

The offset voltage at the loudspeaker terminals should not be more than some millivolt. Without C2, the gain is 20 dB over the whole frequency range (< 50 kHz). If the input offset of the amp is e.g. 3 mV, then the output offset will be $10 \times 3 \text{ mV} = 30 \text{ mV}$ which is too much. With C2 the gain will be 1x at 0 Hz = DC, so that the output offset stays 3 mV.

With a (bad) C2 the sound stage becomes unstable. Instruments are moving in the sound stage when the music becomes louder and/or strong basses come through.

Also in: 'I2VC, details on sub-elements' under 'The lp-filter' I came to the same conclusion! The servo (developed by Henk ten Pierick†) should solve the argument at those times: 'no C in the signal path'.

Also the 'Offset' is treated which is no problem for (power) amplifiers if an op amp has been used as input stage because the long tailed pair is in one and the same can so that no temperature differences appear in the equal transistors of the pair.

Another servo-problem appears in: 'Another Phono Amp for MD-cartridge'. I think that the $120 \mu\text{F}$, (C1) under 68Ω !! to suppress the rumble from the turn table, gives the same problem. This becomes the next investigation project.

Conclusion

Servo circuits in audio diagrams often cause problems in the phantom sound image projected by the stereo speakers. The placing of the (phantom) sound sources are inaccurate and/or are instable. The solution is to use adequate capacitors in the signal path or add DC-current into e.g. long tailed pairs to eliminate the offset.