The 741 Opamp.

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HISTORY & USAGE

The 741 is now only of historical interest. In its day, however, it was a most important and significant development. Here is some information on an old friend...

To my mind, the first really practical opamp was the National 741. It was highly effective in most respects, but burdened with a slewrate of 0.5V/usec, which made a full output swing at 20 kHz impossible; you got only stunted triangles. The 741 was followed by an avalanche of different opamp types, but only a very few have seen extensive use in audio.

The 741 had (and indeed has) effective short-circuit protection and internal compensation for stability at unity gain, and was much easier to make work in a real circuit. It was clear that it was a bit noisy compared with discrete circuitry, and you had to keep the output level well down if slew limiting was to be avoided, but with care it was usable in audio.

Probably the last place the 741 lingered was in the integrators of state-variable EQ filters, where neither indifferent noise performance or poor slewing is a problem.

The LM741 is a single opamp. The dual version is the 747.

Here are the vital statistics:
All typical values, for +/-15V supply rails.

Supply voltage	+/-15V abs max
Output range	+/-13V typ (2K load)
CM range	+/-13V
en	** nV/rtHz typ 1 kHz
in	** pA/rtHz typ

Ibias	80 nA typ into inputs from +V
Slew rate:	0.5 V/us
Supply current	1.7 mA
Unity gain stable	YES
Cost	37p RS Jan 2001

There were no noise density specs in the Texas databook.

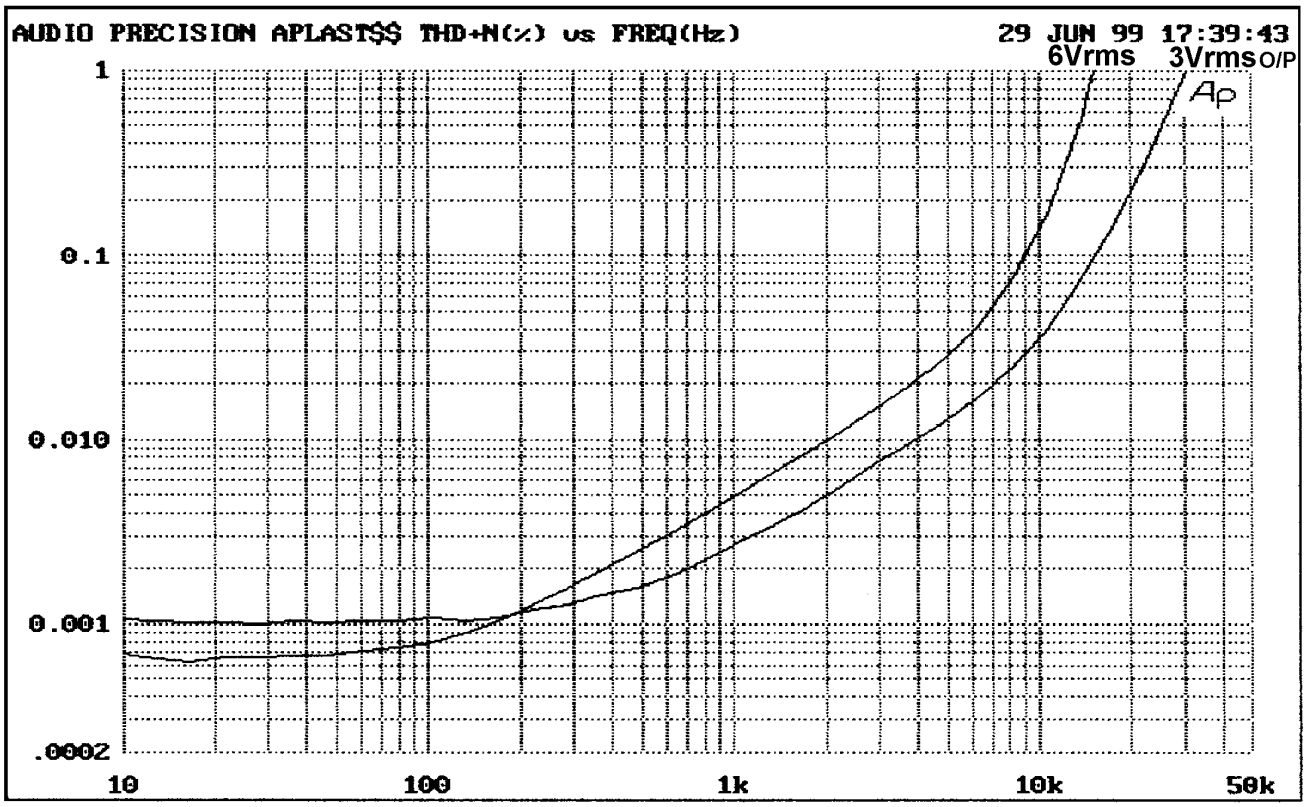
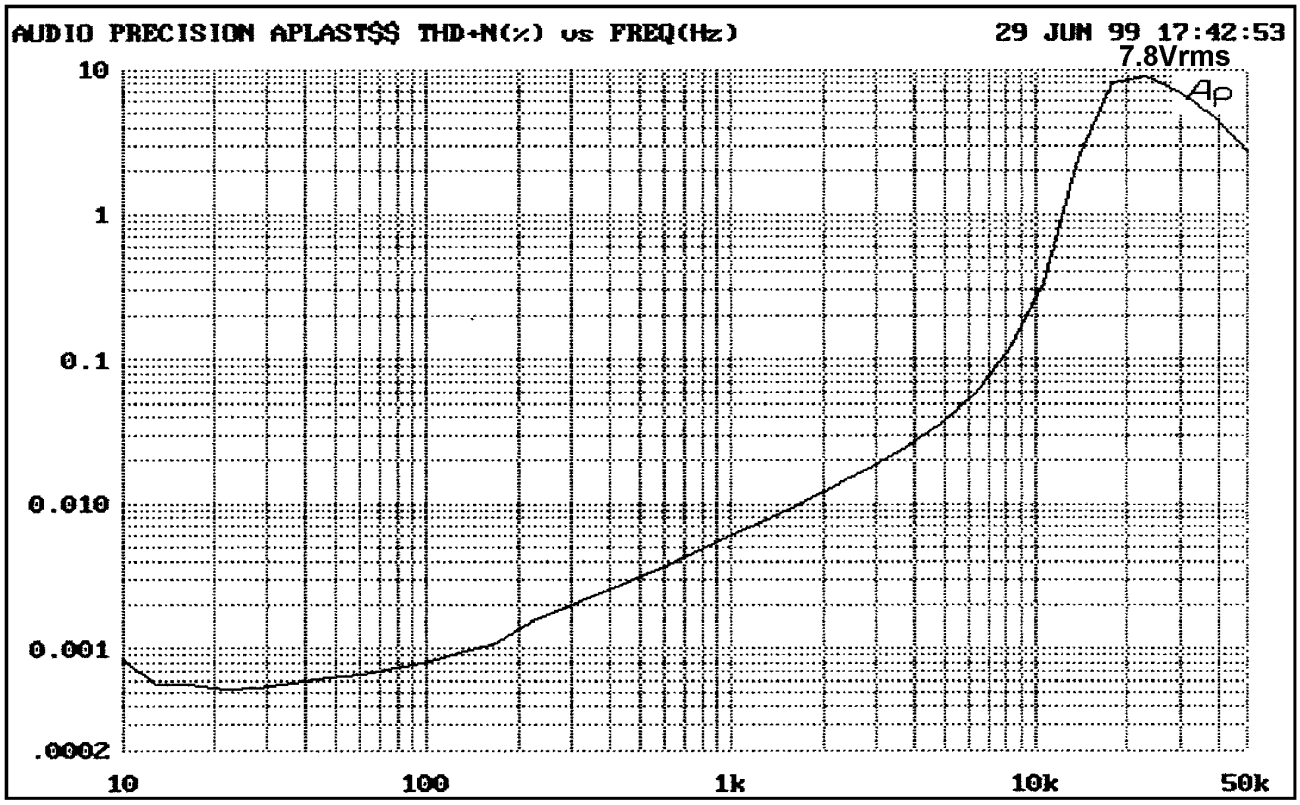


Fig 1
A 741 working at a gain of 3x, on +/- 15V rails, giving 3Vrms and 6Vrms outputs, with no load. In the 6Vrms case, slew distortion exceeds 1% before 20 kHz is reached; there is visible slew-limiting in the waveform. THD is however very low at 100Hz, due to the high NFB factor at low frequencies.

(op741.gif)

Fig 2



A 741 still at a gain of 3x, but giving a slightly larger output of 7.8Vrms. Slewing distortion now reaches 8% before 20 kHz, showing how quickly things go bad when you hit the slew limit.

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Both Figs 1 and 2 show a region between 100Hz and 4kHz where the distortion rises at 6dB/octave. This is the result of the usual dominant-pole Miller compensation scheme; audio power amplifiers show the same behaviour. When slew-limiting begins, the slope increases as THD rises rapidly with frequency.

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