

Linear Amplifiers for Piezoelectric Actuators.

Hervé Fabbro - CEDRAT RECHERCHE.

After the development of switching amplifier SA75 for piezoelectric actuator driving, CEDRAT RECHERCHE has developed linear amplifiers. The LA75 electronics (cf. fig 1) are presented in the form of a 19" rack, and are proposed into various versions.

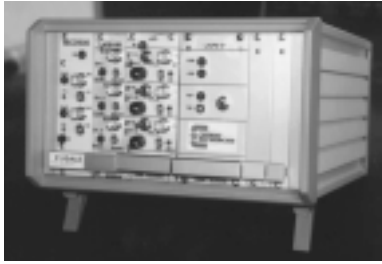


Figure 1: LA75 Electronics - CEDRAT RECHERCHE.

The basic model is formed by a 40VA power board (LA75-P) and an amplifying board (LA75-A) with at least one output channel. A controlling input voltage ($-1V < V_e < +9V$) provides proportional control of the output voltage ($-20V < V_s < +180V$). The LA75 electronics allow to obtain a bandwidth (at -3dB) of 300Hz on a capacitive load of $0.7\mu F$ (cf. fig 2), with a Signal / Noise rate of 0.1%. Note that a greater precision can be obtained by reducing the bandwidth.

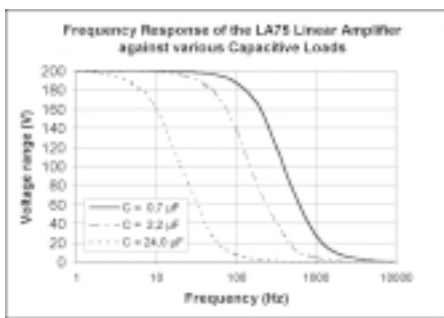


Figure 2: Bandwidth of the LA75 - CEDRAT RECHERCHE.

The LA75 electronics allow to naturally power simple capacitive loads (cf. fig 3a), but also symmetrical Push-pull mechanical loads (cf. fig 3b), such as piezoelectrics Tip-tilt (cf. fig 4) by

means of only one amplifying channel. In order to do so, we just have to superimpose on the dynamic signal, a DC signal either by the control input signal or by the means of the potentiometer at the front.

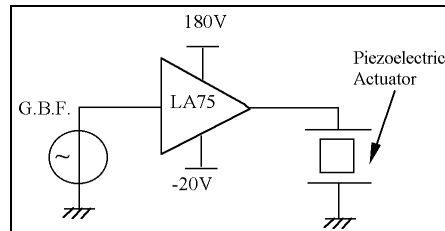


Figure 3a: Circuit with classical load.

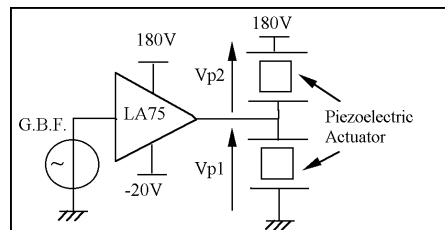


Figure 3b: Circuit with symmetrical load (Push-pull).

Therefore, in the absence of a dynamic control signal, the two actuators will receive an average voltage of 90V. The presence of a reference voltage will result in an increase of the voltage at the terminals of one actuator but will decrease the voltage at the second one (cf. fig 5). That causes for one of them to contract, as the other one will elongate. This powering configuration for Push-pull

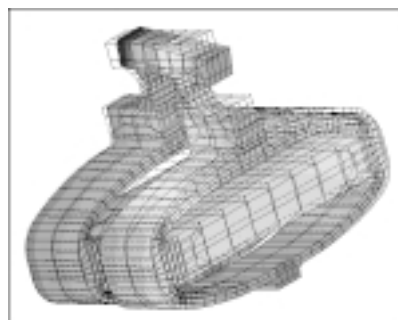


Figure 4: Tip-tilt structure at rest ($V_{p1} = V_{p2} = 90V$)

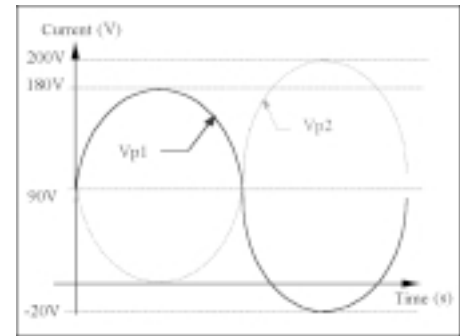


Figure 5: Voltages at the Tip Tilts' terminals.

mechanics is particularly well adapted for producing a rotational effect at the level of the hinge of the Tip-tilt (cf. fig 4). An obvious application is the deflection control of a light beam by fixing a mirror on the hinge. The LA75-A amplifying board is available into 1, 2 or 3 channels. Several LA75-A boards may be placed in parallel. A gage-conditioning module (LA75-SG 1, 2 or 3 channels) may be integrated, giving the possibility of closed loop control.

The combination of power electronics, multi-channel control and DPA, APA, XY piezoelectric actuators offer the most complete range of electromechanical functions, such as those often required in instrumentation or optics.

Hervé Fabbro -
CEDRAT RECHERCHE .

We'll enjoy welcoming you
at the MICAD 2000
(Booth E24)
Porte de Versailles, Paris
March 28 - 30 2000.

