Voltage Controlled Gain Amplifier Utilising TRAC

Kambiz Pourhady

The TRAC family of totally reconfigurable Field Programmable Analog Devices offers an integrated path from signal processing problems to working silicon solutions - in minutes!

Introducing a Top-Down, Structured design discipline, TRAC enables rapid implementation, prototyping and product release. Rather than designing at the component level, TRAC champions a Computational Approach. Using eight simple mathematical building-blocks, any transfer function or mathematical equation can be implemented on TRAC, and more besides!

With a combination of programmable silicon and design software, TRAC brings a truly Integrated Route to signal processing problem solving, providing designers with benefits formerly associated only with programmable digital devices, and offering a path to Custom Silicon for higher volume users.

Introduction

Voltage controlled gain amplifiers (VCA) find applications in many areas where the property of varying the gain of an amplifier electronically (automatically) is useful, such as for small-signal attenuators, voltage tuned filters, and automatic gain controllers (AGC).

Consider a radio receiver that is re-tuned from a weak to a strong station, the volume level will be uncomfortably high. To minimise this effect, most receivers employ Automatic Gain Control (AGC) techniques, the basic element of which is a voltage controlled gain amplifier.

Working at higher level of abstraction, the TRAC design for a VCA simply consists of a multiplier (please refer to AN5 for complete detail on multiplier design utilising TRAC) taking the input signal to be amplified and a control voltage for altering the gain.

The gain of the amplifier can be controlled by varying the control voltage Vc as illustrated in the TRAC design.

Theory of Application

This application note intends to demonstrate a generic technique of voltage controlled gain variation which may also be regarded as amplitude modulation.

This TRAC design multiplies the input signal by a control voltage (AC or DC).

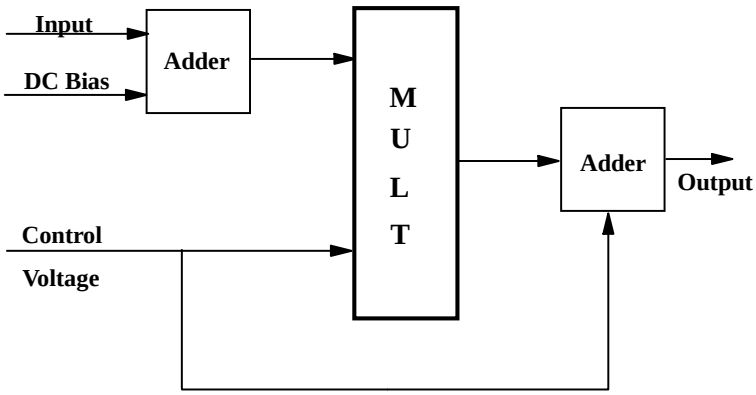

Figure 1
The block diagram of the Voltage Controlled Amplifier (VCA)

In this example a triangular waveform has been chosen for altering the gain and hence the output of the amplifier.

The block diagram for this generic design is shown in Figure 1.

In many applications such as AGC, the control voltage is simply a DC signal which varies with reference to the output voltage.

Software

Adopting the "computational approach", the TRAC software and simulator enables the designer to use the required functions and operators, in this case a multiplier and wave shaping modules in order to form a voltage controlled gain amplifier.

The simple nature of the design shown in Figure 2 demonstrates the power and versatility of TRAC in a variety of complex applications.

Simulating the design (taking only few seconds!) will outline the successful implementation of TRAC for this rather generic and potentially complex design.

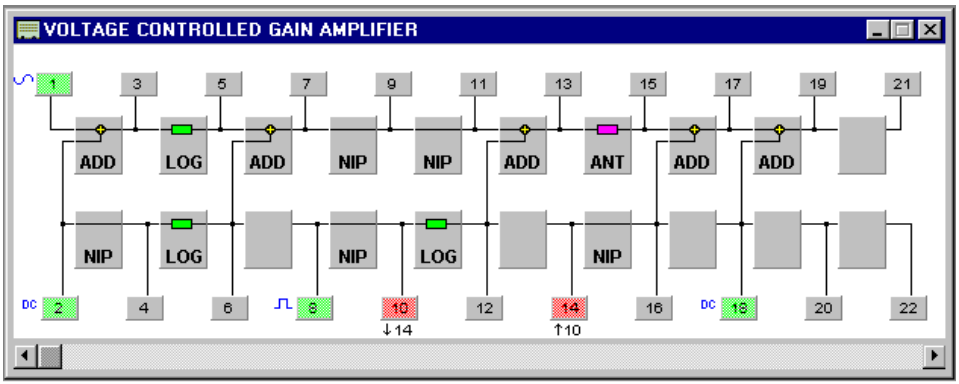

Figure 2
TRAC design of a Voltage Gain Controlled Amplifier

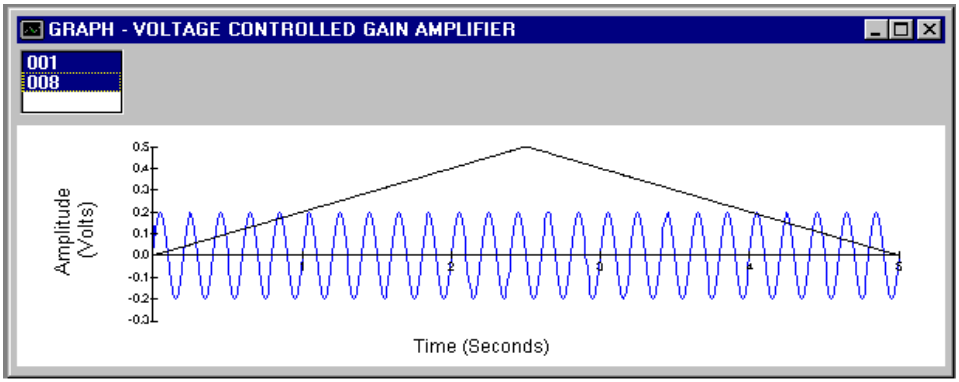

Figure 3a
Control Voltage and the Input Voltage

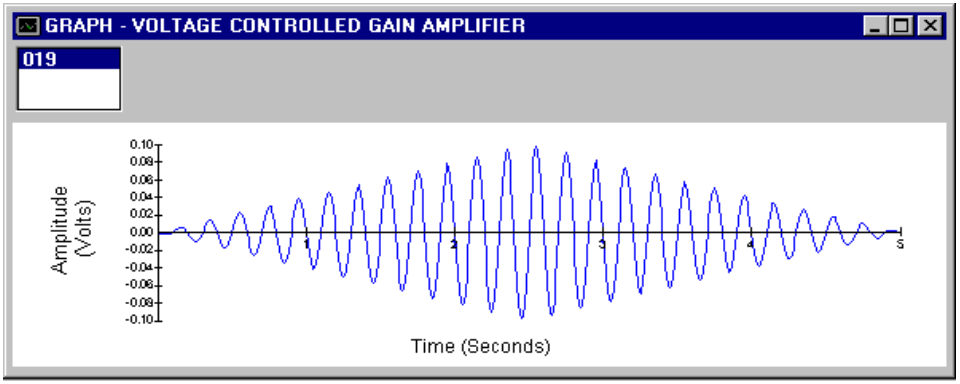

Figure 3b
Output Voltage

Fast Analog Solutions Ltd.
Fields New Road, Chadderton, Oldham, OL9 8NP, United Kingdom.
Tel: (+44) (0) 161 622 4567 Fax: (+44) (0) 161 622 4568
e-mail: trac@fas.co.uk Internet: http://www.fas.co.uk

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