Voltage Controlled Oscillator Utilising TRAC

Ian Shaw

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

The basis of this application note is the integrating oscillator described in Application Note AN18 which includes the theory of the integrating oscillator. If knowledge of this theory is required, then the reader should become acquainted with the contents of Application Note 18.

Theory of Application

A simplified block diagram for the voltage oscillator utilising TRAC is shown in Figure 1.

The main difference between the voltage controlled oscillator and the integrating oscillator is the inclusion of an adder stage, which enables the threshold voltage of the integrator to be

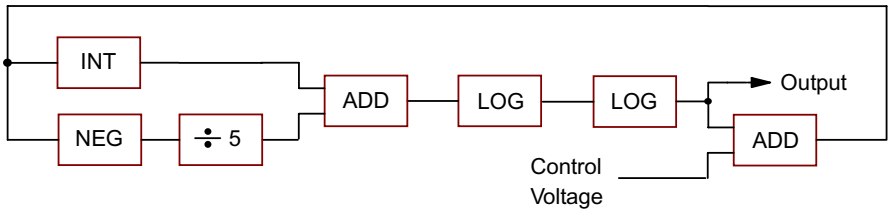

Figure 1
Block Diagram of the Voltage Controlled Oscillator

varied, and hence the integration time. Although this produces a very effective frequency control for the oscillator, the waveform is not symmetrical. Should this be required then a simple 'divide by two' stage could be added to ensure an equal mark-space ratio.

Software

Adopting the "computational approach", the TRAC software and simulator enables the designer to use the required functions and operators, in this case an Integrator, Adder, Amplifier and a Log cell in order to form a voltage controlled oscillator.

With reference to Figure 1, it can be seen that the block diagram has been directly transferred to TRAC as shown in the design (Figure 2) except that the NEG function has been replaced with an adder. This is being used, not as an adder, but simply to link the waveform on I/O 1 to I/O 2 without the need for an external link. The adder, of course, also performs the required inversion and still utilises only the one cell, which would have been required for the NEG cell.

The second LOG function is used both to invert the signal and to ensure a clean squared waveform.

The control voltage is applied to I/O 14 and has an effective range between 0.1 and 0.7 volts as shown in Figure 3. Using a time constant of 10000 for the integrator, this will give a range of about 1 kHz to 10 kHz. Suitable resistor and capacitor values to achieve this time constant are 10 kΩ and 10 nF.

The amplifier has been designed to have a 'gain' of 0.2 and this has been achieved with a resistor from I/O 4 to I/O 6 of value 15 kΩ and a resistor from I/O 6 to I/O 8 of value 3 kΩ.

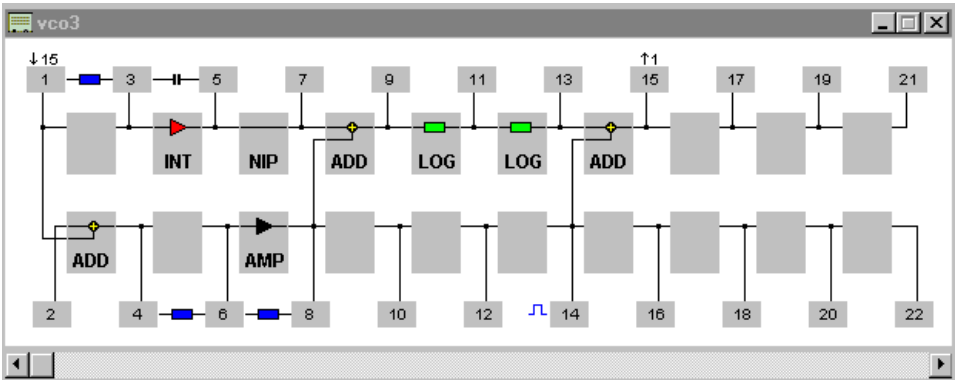

Figure 2
Voltage Controlled Oscillator Design Utilising TRAC

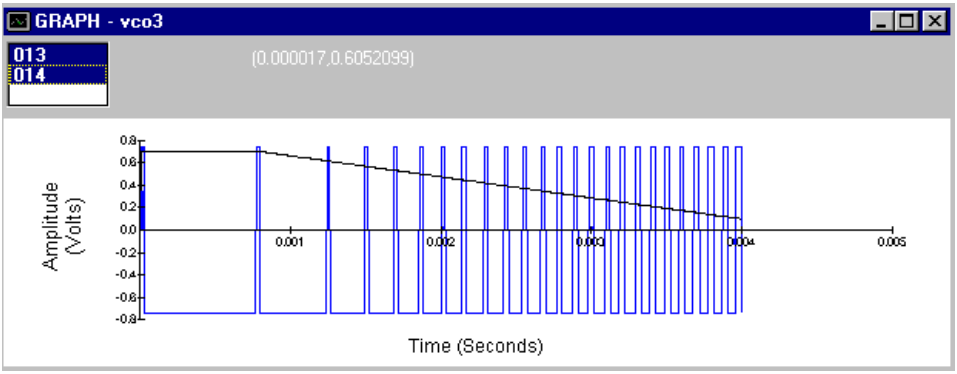

Figure 3
The simulation result showing the control voltage and the output

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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