Programmable Analogue Circuit in Reconfigurable Systems

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Abstract: The two not independent steps of the planning of analogue electrical circuits: the implementation of the topology and the defining of the parameters of the spare parts. We are forced to use the same topology of partial electrical circuits that have different parameters from each other and robust, multiple repeated ones for certain applications. In such an analogue system in the same time, functionally, only certain parts will operate.

1 Why Reconfiguration in Electronic Circuits

For the sake of the implementation of the economical functions of the analogue system, we can use Programmable cell-block electrical circuits. So we can implement more reliable systems according to changed environment in a smaller place and performance needs, if we could have the possibility to change its function without disturbing the operating electrical circuit, taking into account either a new topology, or new parameter.

There are two independent steps of system design via analogous circuits:

- creating connection,
- determining component parameters.

For certain applications we have to build exclusively robust systems, which are made up of multi alternating sub circuits with the same topology and only according to their parameters. Only certain parts of such analogous systems operate at a time. In the case of the application of field programmable analogue arrays (FPAA) circuits, more compact, more reliable systems can be formed with less performance-needs, which can better be adjusted to the changed conditions, provided, we could modify its function through either a new topology or a new parameters without disturbing the operation of the circuit of big analogue systems in progress.

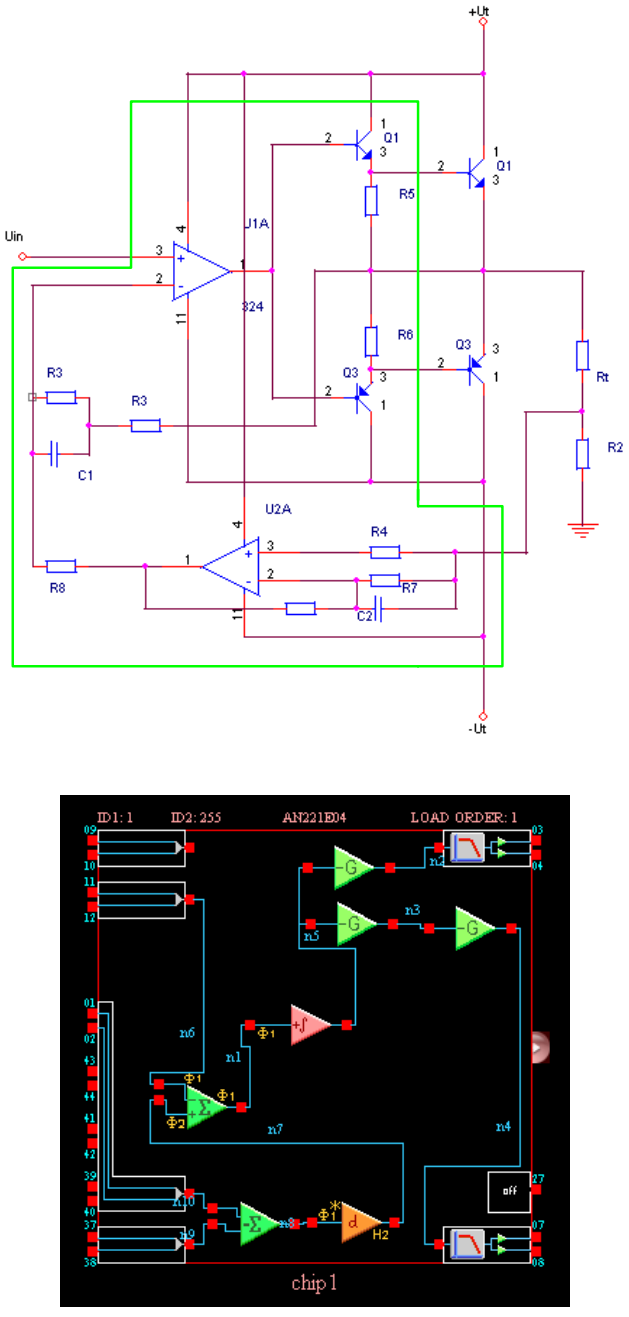

Figure 1
A traditional servo amplifier (up) and its part (inner in green line) in FPAA cell

Some component manufacturers, his hope of bigger market share, distribute programmable FPAA suitable for the purposes described above. These circuits being programmed via digital surface form analogous circuit topology together with the likewise programmable determined circuit parameters. As a consequence, they can be favorably used to create different functional units. Thus, reconfigurable systems can be made, particularly i fan embedded microcontroller is provided.

The systems made up in this way, on one hand can be configured under the supervision of a central controller; on the other hand, they fulfill certain functions independently (in a self – organizing way). Such a 'self-adjustment' needs a feedback which varies according to the quality parameters of the circuit formed in this way.

2 Abilities by the Using of FPAA

2.1. Realization any Part of the Analogue Circuit in FPAA

By means of this method, using FPAA -circuits sub functions of a more complex system (device, equipment) can be fulfilled in a reprogrammable way on a unitary digital surface (Figure 1).

$$F_{io}(t) = \sum_{n} (f_{bk}{}^{n}(\varphi, t) + C_{ea}{}^{n}(\eta, t)) \tag{1}$$

where:

f_{bk} the functions describing the input–output connection of the programmable analogous cellblock-circuit
C_{ea} the functions describing the input – output connection of the circuit not implemented int he programmable circuit
n the number of the programmable analogous cellblock-circuits, and that of the supplementary circuits (C_{ea})
p parameters describing circuit operations.

2.2. Latent Circuit Realization with FPAA

By means of this process (2) in a programmable analogous cellblock-circuit certain sub functions (f_{bk}) of an analogous system can be carried out in a way that, aiming the permanent optimal operation of the system, these sub functions are reconfigurable without disturbing the system operation. (Figure 2).

$$F_{io}(t) = \sum f_{bk}(t) + C_{ea}(t) \tag{2}$$

where:
F_{io} the functions describing the input–output connection of the entire circuit.

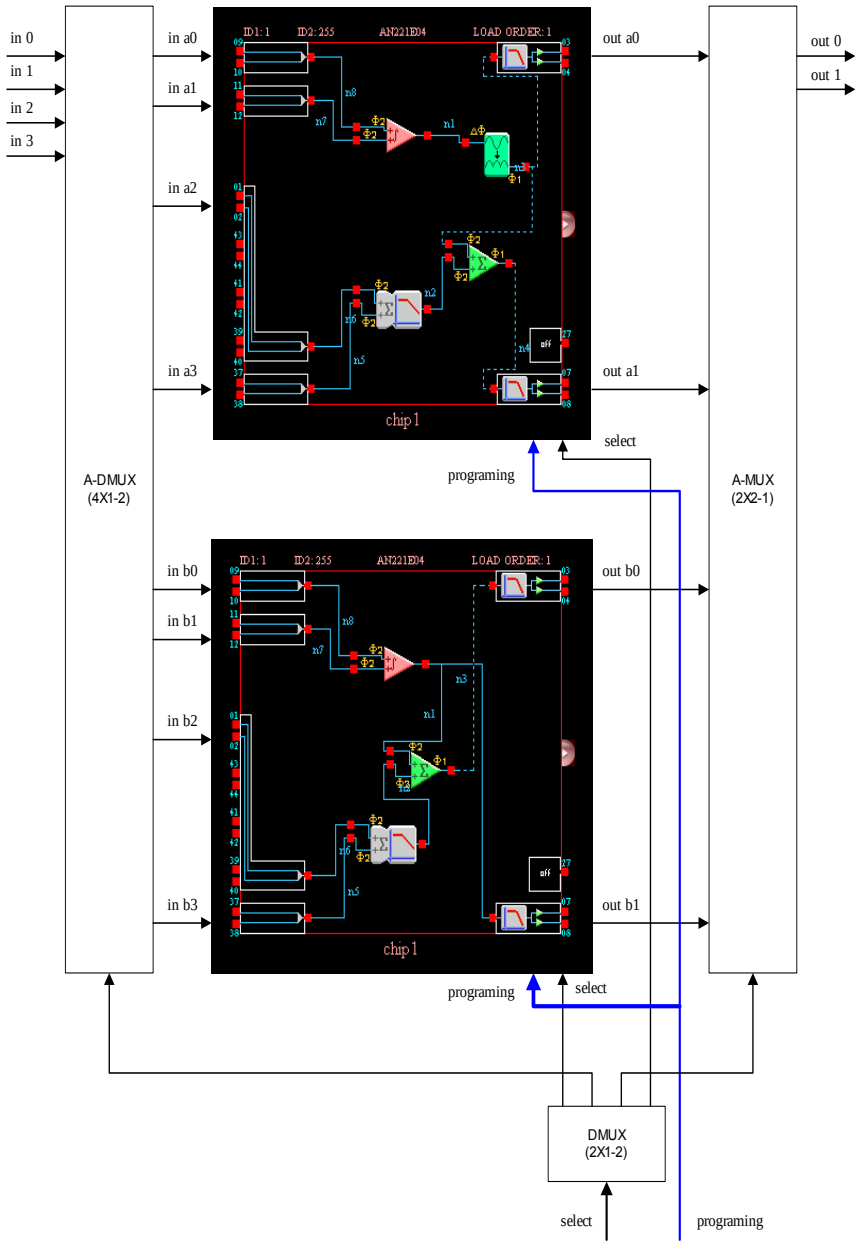

Figure 2
The latent reconfiguration of parallel FPAA

2.3 Self Organizing by FPAA

Thus, (3) through the cooperation between the FPAA and the microprocessor, a dynamically configurable (reconfigurable) analogous circuit can be made, which is able to self-organize itself. (Figure 3)

$$f_{bk}(t) = f(P_0, M, S, t) \tag{3}$$

where:
P_o the topology and parameter function (?) of the initial function of the programmable analogous cellblock-circuit
M the topology and parameter description of the currently used function of the programmable analogous cellblock-circuit
S the appropriately chosen feedback and output characteristic of the programmable circuit.

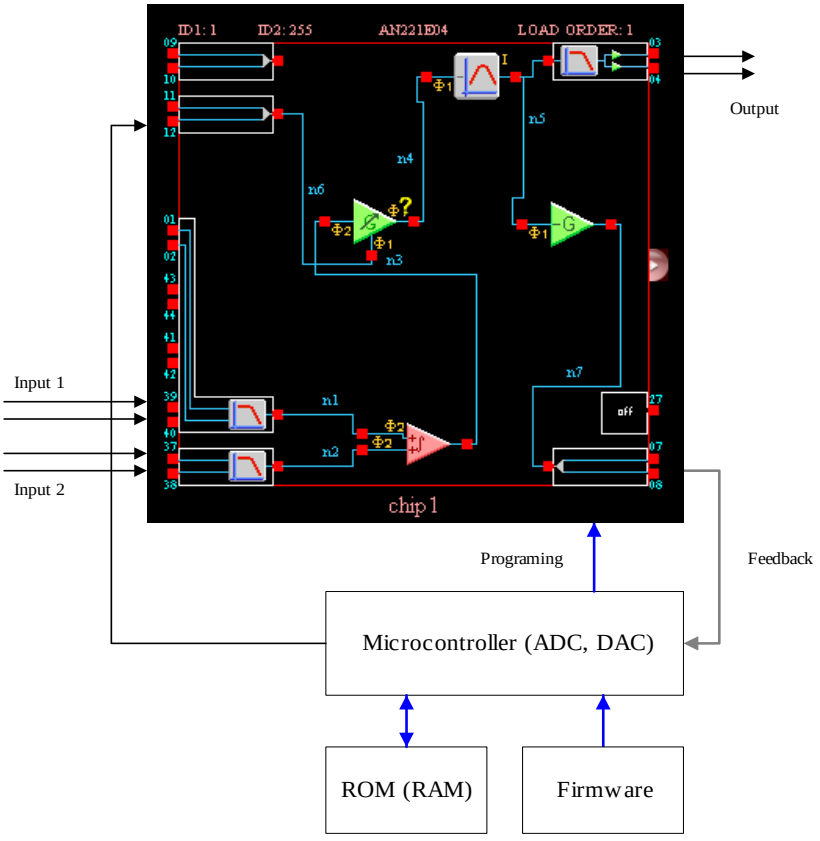

Figure 3
In EKG input amplifier and filter the FPAA reconfiguration cell

3 Applications in Practice

The paper shows several real practical applications with the aim of releasing the characteristic of the elaborated procedures. The quickly programmable analogous circuits are particularly applicable in measurement devices where the measurement task, its quality and accuracy can necessarily vary.

These pieces equipment are production – supporting autonomous measurement devices which are supposed to give the most parametric features best serving error analysis and quality assurance. In order to do this, the circuit to be measured is controlled with a specific different signal from the driver side, to the output of the tested board.as well a control-dependent varying signal-processing is carried out.

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