UDC 681.5.013 (045)

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Advanced Approach to Usage of an Electronic Composer

An advanced approach of using the electronic composer has been proposed. The result of semi-automated modeling of the system is estimated as more natural, correct and perspective.

Introduction.

Academician V. M. Glushkov more than forty five years ago stated some new ways to improve systems' characteristics based on AI programs that deal with music composing [1]. Unfoturnately no prominent results [2] were obtained since that time in the research.

Musical stochastic basis.

Let the "white noise" signal act on the input of some device intended to receive an orthogonal stochastic basis. This device is shown in Fig. 1. It consists of an infinite number of hypothetical filters $\Pi_i = f_в^i - f_н^i$, each of which being with the same bandwidth. Filters cover the entire spectrum of the primary signal $\eta(t) = s(t)$ without a mutual overlap, and $f_в^i = f_н^{i+1}$.

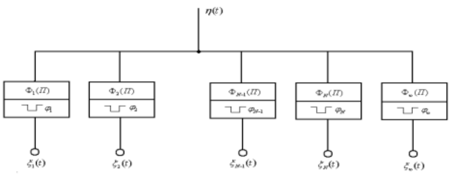

Fig. 1 Scheme for obtaining a stochastic basis

Such a device at its output forms a stochastic basis. This stochastic basis can be either given directly to the object of management, or be "noised up" by the primary signal (1):

$$\overset{*}{s}(t) = \begin{vmatrix} s_{1,1}(t)_k & s_{1,2}(t)_k & \dots & s_{1,N}(t)_k \\ s_{2,1}(t)_k & s_{2,2}(t)_k & \dots & s_{2,N}(t)_k \\ \dots & \dots & .. & \dots \\ s_{N,1}(t)_k & s_{N,2}(t)_k & \dots & s_{N,N}(t)_k \end{vmatrix} \bullet \begin{vmatrix} \xi(t)_1 \\ \xi(t)_2 \\ \dots \\ \xi(t)_N \end{vmatrix} = \begin{vmatrix} \overset{*}{s}(t)_1 \\ \overset{*}{s}(t)_2 \\ \dots \\ \overset{*}{s}(t)_N \end{vmatrix} \quad (1)$$

The code for obtaining a "musical stochastic basis", which in this case consists of five digital filters random1- random5:

```
int random1 (int n){ int res;double temp_res;
do{temp_res=(double)rand()/(double)RAND_MAX; }
while (temp_res<0.2);
res=(int)(n*temp_res);return res;}
...
int random5 (int n){ int res;double temp_res;
do{temp_res=(double)rand()/(double)RAND_MAX; }
while (temp_res>=0.8);
res=(int)(n*temp_res);return res;}
```

The principle of connectionism, well known in the theory of neural networks, gives priority to the matrix of weight coefficients. Therefore, it is possible here to use the automation operator to transform the input signal in a complex form:

$$\begin{vmatrix} \Psi_{1,1}e^{i\frac{180^\circ}{\pi}} & \Psi_{1,2}e^{2i\frac{180^\circ}{\pi}} & \cdots & \Psi_{1,N}e^{Ni\frac{180^\circ}{\pi}} \\ \Psi_{2,1}e^{(N+1)i\frac{180^\circ}{\pi}} & \Psi_{2,2}e^{(N+2)i\frac{180^\circ}{\pi}} & \cdots & \Psi_{2,N}e^{2Ni\frac{180^\circ}{\pi}} \\ \cdots & \cdots & \cdots & \cdots \\ \Psi_{N,1}e^{(N\times N-(N-1))i\frac{180^\circ}{\pi}} & \Psi_{N,2}^{(N\times N-(N-2))i\frac{180^\circ}{\pi}} & \cdots & \Psi_{N,N}e^{N\times Ni\frac{180^\circ}{\pi}} \end{vmatrix} \bullet \begin{vmatrix} s(t)_1^1 \\ s(t)_2^1 \\ \cdots \\ s(t)_N^1 \end{vmatrix} = \begin{vmatrix} s(*)_1^1 \\ s(*)_2^1 \\ \cdots \\ s(*)_N^1 \end{vmatrix},$$

$$\begin{vmatrix} \Psi_{1,1}e^{i\frac{180^\circ}{\pi}} & \Psi_{1,2}e^{2i\frac{180^\circ}{\pi}} & \cdots & \Psi_{1,N}e^{Ni\frac{180^\circ}{\pi}} \\ \Psi_{2,1}e^{(N+1)i\frac{180^\circ}{\pi}} & \Psi_{2,2}e^{(N+2)i\frac{180^\circ}{\pi}} & \cdots & \Psi_{2,N}e^{2Ni\frac{180^\circ}{\pi}} \\ \cdots & \cdots & \cdots & \cdots \\ \Psi_{N,1}e^{(N\times N-(N-1))i\frac{180^\circ}{\pi}} & \Psi_{N,2}^{(N\times N-(N-2))i\frac{180^\circ}{\pi}} & \cdots & \Psi_{N,N}e^{N\times Ni\frac{180^\circ}{\pi}} \end{vmatrix} \bullet \begin{vmatrix} s(t)_1^2 \\ s(t)_2^2 \\ \cdots \\ s(t)_N^2 \end{vmatrix} = \begin{vmatrix} s(*)_1^2 \\ s(*)_2^2 \\ \cdots \\ s(*)_N^2 \end{vmatrix},$$

...

$$\begin{vmatrix} \Psi_{1,1}e^{i\frac{180^\circ}{\pi}} & \Psi_{1,2}e^{2i\frac{180^\circ}{\pi}} & \cdots & \Psi_{1,N}e^{Ni\frac{180^\circ}{\pi}} \\ \Psi_{2,1}e^{(N+1)i\frac{180^\circ}{\pi}} & \Psi_{2,2}e^{(N+2)i\frac{180^\circ}{\pi}} & \cdots & \Psi_{2,N}e^{2Ni\frac{180^\circ}{\pi}} \\ \cdots & \cdots & \cdots & \cdots \\ \Psi_{N,1}e^{(N\times N-(N-1))i\frac{180^\circ}{\pi}} & \Psi_{N,2}^{(N\times N-(N-2))i\frac{180^\circ}{\pi}} & \cdots & \Psi_{N,N}e^{N\times Ni\frac{180^\circ}{\pi}} \end{vmatrix} \bullet \begin{vmatrix} s(t)_1^N \\ s(t)_2^N \\ \cdots \\ s(t)_N^N \end{vmatrix} = \begin{vmatrix} s(*)_1^N \\ s(*)_2^N \\ \cdots \\ s(*)_N^N \end{vmatrix}.$$

Fig. 2 The sound series obtained with the software AQUARIUS ©

Composing by hand.

What is the main advantage of using an electronic composer ? Of course, it's the speed ! By just one mouse click and in a wink of an eye you can get hundreds, thousands or even millions of pages filled with scores. But there's a serious minus, too. As it often happens, automation doesn't mean improvement by default... In order to add real emotions, like joy or sadness, or some special feeling you still have to do it by hand. So, in Fig. 2 four fragments of piano scores named « *Touch Me Softly* » are shown. They have been composed automatically, except the intro and the coda, where the music has been composed by hand.

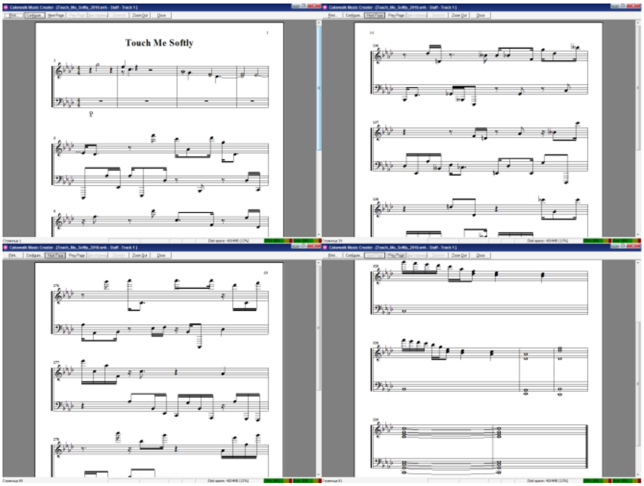

Fig. 2 The sound series composed

Conclusion. We believe this method can greatly increase the quality of the music being created with help of NN AI electronic composing (automation) software.

References

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