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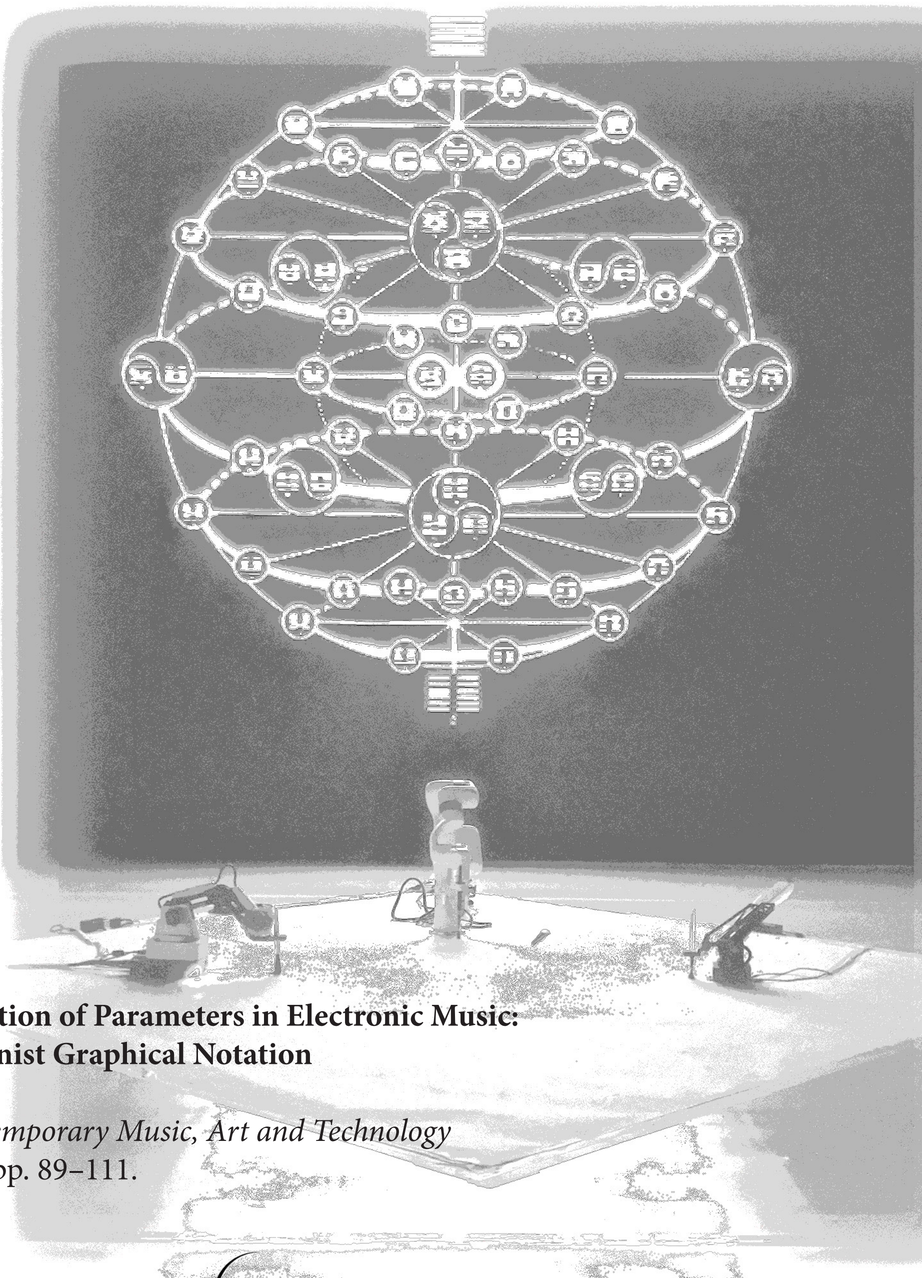

Composition and Notation of Parameters in Electronic Music: Approximate Reductionist Graphical Notation

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INSAM Journal of Contemporary Music, Art and Technology
No. 4, Vol. I, July 2020, pp. 89–111.

INSΔM

UDC 781.24

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COMPOSITION AND NOTATION OF PARAMETERS IN ELECTRONIC MUSIC: APPROXIMATE REDUCTIONIST GRAPHICAL NOTATION

Abstract: Music composition today present a challenge for every composer, student and professor. In addition to the huge amount of information and technology that are part of modern composition, there are different approaches to the usage of notation within various forms of information and technology. This paper is based on the definition, role and application of notation in compositions. It attempts to define and explain a different, specific approach, which helps in understanding the technology, its applications and features to meet the problems of present compositions by using specific notation for electronic instruments or computers. The paper contains three sections with additional information on the problems, the different types of notations, and the possible solutions. The final result is the description of a connection between the electronic parameters of different instruments and the composition through the ARGN approach (Approximate Reductionist Graphical Notation), which is achieved by means of notation and composition of the parameters of electronic instruments. The ARGN approach contains elements of artistic and theoretical practices based on an interdisciplinary perspective; of the composer, engraver, performer, and improviser, which today represents a profile of a contemporary composer.

Keywords: composition, parameters notation, electronic music, sound synthesizer, sound modulation[1]

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1. PROBLEMS AND PROCESSES PRESENT IN NOTATION OF PARAMETERS OF ELECTRONIC INSTRUMENTS

Parameter notation is a serious challenge due to the connection between notation and parameters, which leads to the complexity of the notation itself. It is almost impossible to find a universal and unified solution that would eliminate the problem present within notation for electronic instruments. However, by researching musical texts of relevant compositions that contain similar content, it is possible to identify some individual solutions of the authors themselves. The solutions offered by various composers of contemporary art music for acoustic, electro-acoustic, and electronic instruments in their works should be landmarks for creating an individual system of musical notation. By researching different compositions related to electro-acoustic music, computer music and live electronics, it is possible to come up with some favorable solutions for creating individual notation models. Individually, each work has its own peculiarities in the structural sense, as well as in the arrangement of instruments, and even in the connection of these factors. If we are discussing analog modular instruments, then the approach is completely different from that of performing electronic instruments. The parametric network itself among the components or modules can be pre-determined in the legend, which is a good starting point for the practical performance of operating objects that represent the parameters of the parametric grid. More precisely, we can use objects, in terms of related parameters-driven modules, that can be graphically represented in a musical text.

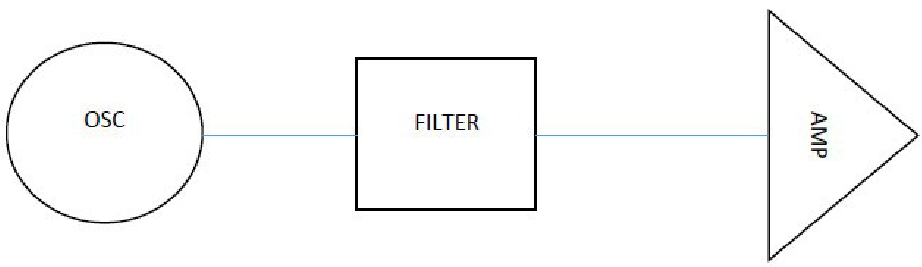

Figure 1. Graphic presentation of the basic elements of electronic music.

Graphic visual presentation is necessary for clarity, which is important for the quick reaction of musicians. Simplified: a circle represents an oscillator, a square a filter and a triangle an amplifier. This approach, through different geometric shapes, allows direct connection to controllers. However, the problem with this type of notation is the inability to change the connectivity of fixed component arrangements. The reason for that is the previous arrangement of the modular grid in the legend of the composition. Simple software that can edit parameter values can help in the further process of finding the most efficient solution.

Positronic Rhythm

Oscillator 1 Wave: Sawtooth Tune: -2 oct Mix: 0dB 100% Oscillator 2 Wave: Square Tune: -1 oct Mix: 0dB 100% Osc 2 Track: on Osc 2 Sync: off	LFO Routing: LFO routing and depth – Pich osc1, osc2 = 7 semitones; PW osc2 = 100%	Low-pass filter Cutoff $\frac{24\ dB}{165\ hz\ 30\%}\ \frac{12\ dB}{165hz\ 30\%}$ Resonance: 45% Envelope: 100% A 3.30s D 4.00s S 0% R 2.90s
Noise: off Mix: -	Glide: off Time: - Unison: off Voices: multi	Amplifier A 0s D max S 100% R 0.80s

Figure 2. Representation of the written sound program of the sound *Positronic rhythm* (Welsh 2006, 109).

As shown in Figure 2, the elements of sound synthesis are separated by fields of squares. Between them are modulators. The controllers are in the element and modulator sections. The parameter used by Welsh contains a unique scale in percentages, combined with time and quantity designations. This system is taken from the old system of sound programs (patch) for subtractive synthesizers (Pinch & Trocco 2004, 192). Observing the simplicity of interface programming, this system of parameter notation meets the requirements related to simplified modulations that do not contain too many modulators and modules. A problem arises, however, with complex modulations and complex connected systems which require more efficient notation. Combining the recording of live electronic and acoustic instruments creates even further problems with notation.

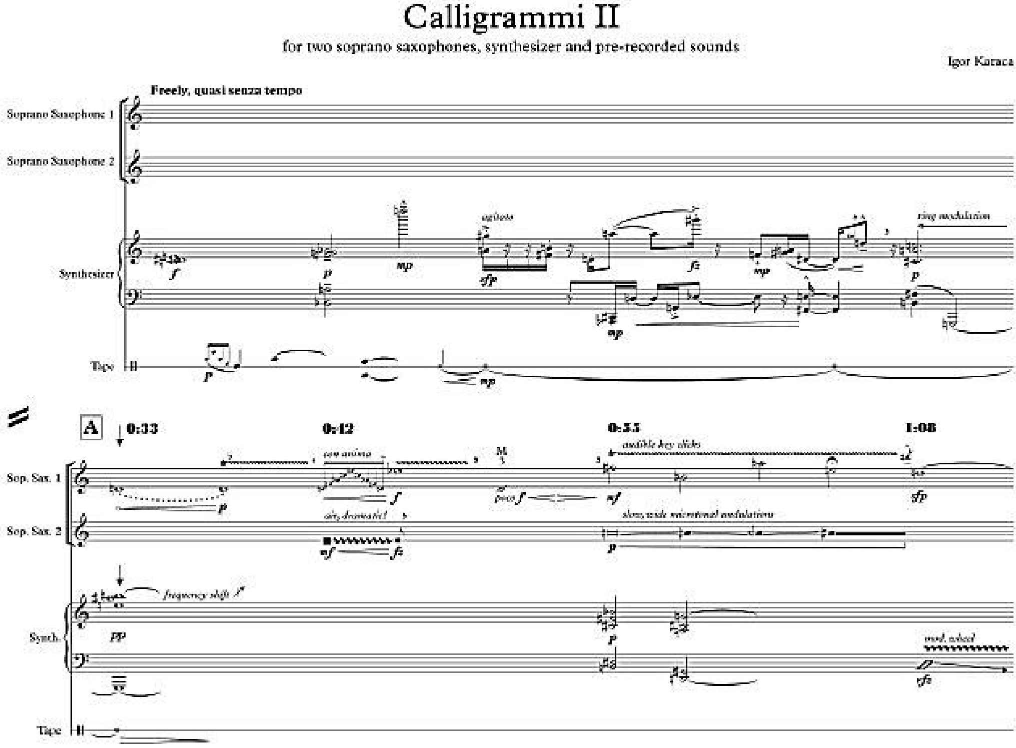

Figure 3. *Calligrammi II* by I. Karača (Karača 2012, 1).

One solution is shown in Figure 3, which could solve the problem of regulation of recorded electronics (tape) and acoustic instruments in a musical score. Karača solves the problem of notation by marking the most important elements of the electronic recording, reducing these only to time regulations in relation to the performances of musical gestures. Through certain time intervals, the intrusions of acoustic instruments are defined precisely, enabling a consistent performance. Karača's time code is a simple and functional solution that can be applied to the notation of electronic musical parameters for live performances. This notation of time through a reductionist approach to the dynamics of parametric changes can serve as a model for the musical notation of musical syntheses in electronic music. The notation of the synthesizer is concrete and refers to the clear requirements of the composer. The notation of complex modulations for a synthesizer, however, requires the principle of combining several notation examples, where the mentioned composition helps to find a solution with a reductionist model of electronic recording notation. Complexity and efficiency are the greatest torments for composers because they are the natural enemies of musical notation. It is almost impossible to find an appropriate solution in terms of a universal approach to this problem. The only possibility is to find different models that would correspond to the conceptual solution of notation parameters.

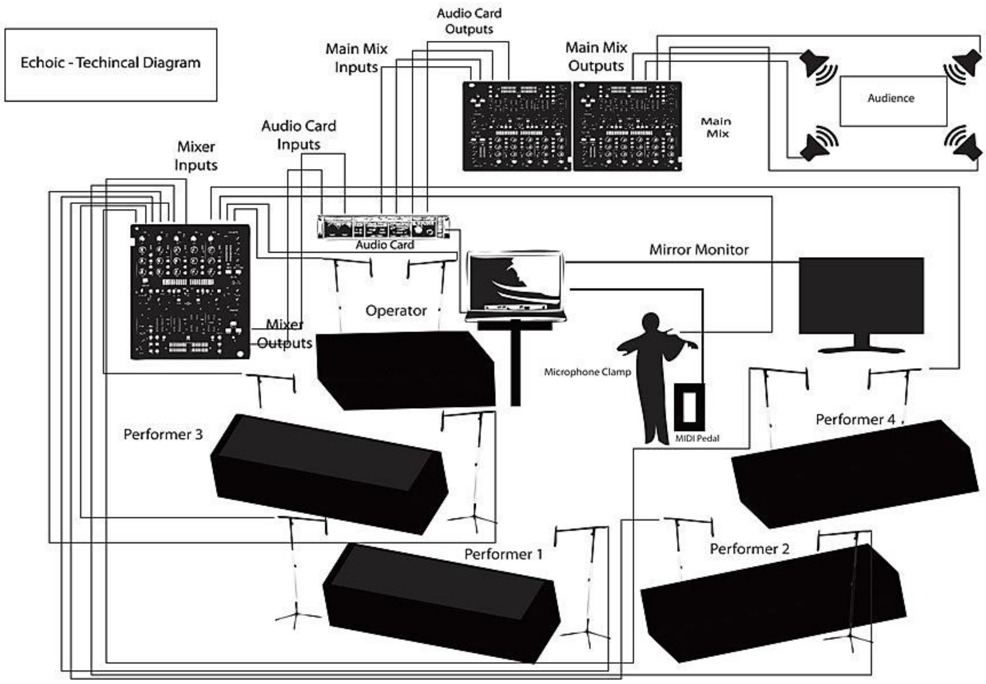

Figure 4. Technical diagram and disposition of performers, instruments and musical equipment for composition ECHOIC by E. Barroso (Barroso 2012, 4).

An example is the pictographically marked arrangement of instruments and electronics on stage. This way of marking is to determine the elements of the system in the legend of the musical text. Electronics (all electronic instruments and their means) require a specific disposition, as otherwise, the composition may be misinterpreted. Barroso solves this problem with the traditional approach found in K.H. Stockhausen in the composition Mixtur back in 1965. In this composition, in addition to acoustic instruments, Stockhausen also uses oscillators, amplifiers, and ring modulators that are connected into a single system with instruments via a microphone (Read 1998, 237). Thus, notation refers not only to musical parameters, but also to all descriptive elements that represent an important factor for the realization of the work. A disposition on the connection of sound synthesizers with other instruments or electronic modules is necessary information. This information provides a clear picture of the relationships and positions of the instruments, which can serve in shaping the musical score of the parameters of electronic instruments. Notation of parameter, for live performances, is another problem in the mosaic of information for notation, which requires careful planning and clear descriptions. The instructions necessary for performance should be concise and clear. In addition to all the complex relationships, modulations, and parameters, it is necessary to take into account the clarity of the musical score.

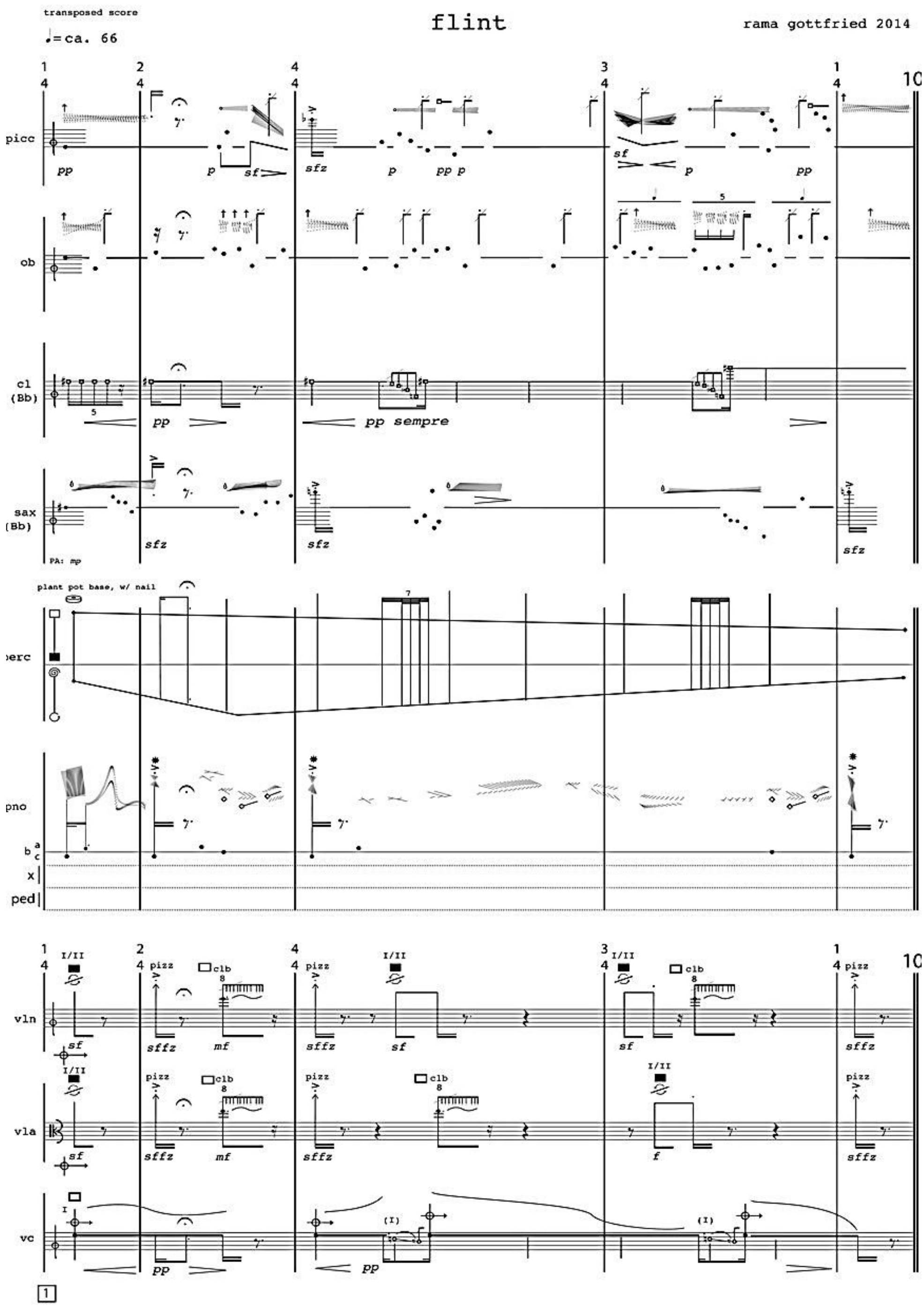

Figure 5. *Flint* by R. Gottfried (Gottfried 2014, 1).

This example of a composition Flint by R. Gottfried (Figure 5) is a simple, clear and graphically arranged musical score. In essence, in the legend of this work, all the relations and parameters of music are strictly determined and it is impossible to perform a work without its diligent and thorough understanding. Such a solution is not a simplification of musical parameters, but shows a possibility of a systematic approach to overcoming the problems associated with the complexity of artistic contemporary music. Although the above composition does not contain the instruments or parameters of electronic music, it nevertheless explains possible solutions to problems related to the logic of writing music in the 21st century. An important segment of the musical text of the composition Flint is the idea of musical manners, which are spatially arranged and determined. However, the control of electronic music parameters again requires other solutions.

Figure 6. *Persistence* by I. Karača (Karača 2014, 1).

Karača's composition (Figure 6) was written for two baritone saxophones and a tape on which electronic music was recorded, but it contains an important segment that can offer a solution for notation of parameter. As can be seen from the music text, the operations contained in the tape are marked. These operations are also precisely rhythmically and manneredly notated to enable easy reading. This approach marks an important segment in solving the problem of notation of parameter. It is necessary to observe the notation of live electronics in order to apply changes related to parametric controls and their regulation in real time.

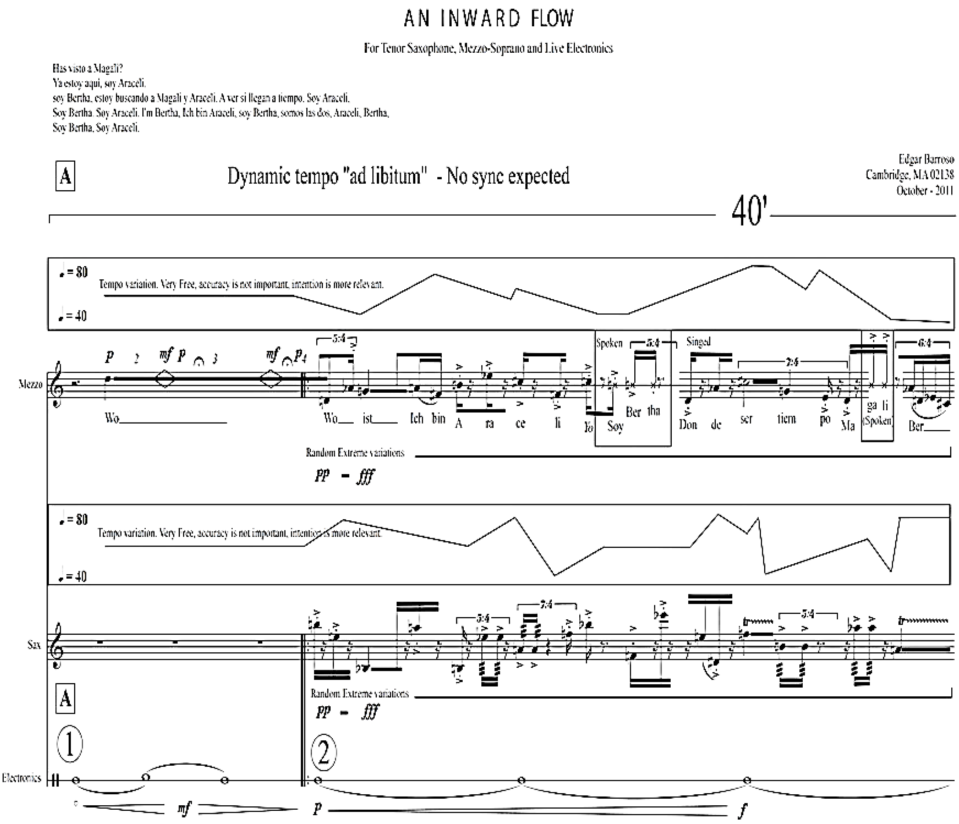

Figure 7. *An Inward Flow* by E. Barroso (Barroso 2012, 1).

It is possible to notice that Barroso's composition (Figure 7) shows electronics reduced to a minimum amount of rhythmic values and activities. One important parametric regulation is that of dynamics and temporal fluctuation. By regulating these parameters, it is possible to generate a feeling of an increasing or decreasing pulse through rhythmic changes occuring in proportion to the tempo. Thus, with the shown examples, it is possible to construct a notation system depending on the requirements of the composer. The similarity in all the examples discussed above allows for a simplification in the musical notation of the parameters. The basic reductionist principle requires previous explanations in the legend of the work, as well as a clear disposition of all instruments, gestures, equipment and other factors present in the musical composition. A general system however is not possible, due to parameters of the different instruments and the systems or way by which they are connected, the acoustics, and many other important factors. Electronic instrument components may be separately represented in the notation. An example of this can be found in I. Karača's *Persistence* (Figure 6). If it is actually a modular system, then the connection of all modules should be explained in the legend, however problems arise due to direct changes in the connectivity of the components in real time. This problem can be solved with graphically represented components shown in the Welsh table. Each component should contain a geometric shape and a label, yet a table of related components in live electronics, or examples with recorded electronics, should not be present in the performance score. This is due to transparency, and a spreadsheet system would only serve the purposes of pre-programmed sound textures.

Electronic music and notation

The basis and history of musical notation can be presented through gradual steps from acoustic to electronic music. Regardless of the medium, outcome, and manner, the notation of music contains similarities in their presentation and interpretation. While most modern compositions have been written under the influence of new technologies, there are similarities in the compositions for acoustic and electronic instruments. The most common applications that form the basis of modern notation are reductionist musical images shown graphically. Similarities can also be indicated through legends, a necessary feature in today's notation. The project is described through legends. The composition as well as architecture, or electrical engineering, requires a concrete translation of units and a clear standardization of their values. Parameter units are defined in four groups. First, is the percentage scale of values as by Fred Welsh. Second, is another scale of values presented by the same author, which is a parametric scale of individual parameter values. Third, is a value scale present in the MIDI protocol with its scale based on digital technology. This group defines all

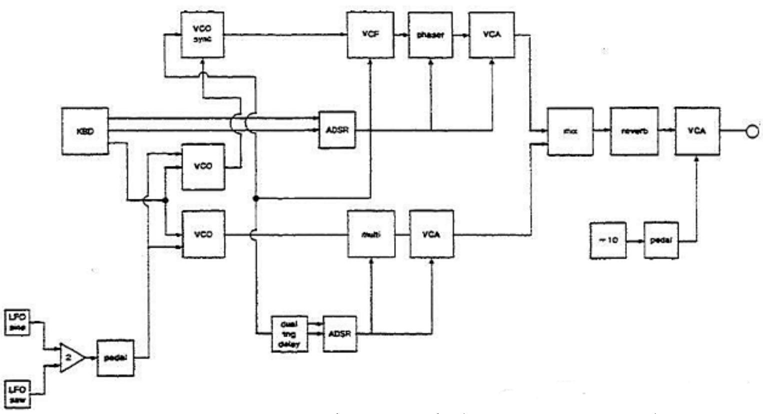

Figure 8. *Orion Rising* by M. Styls (Strange 1972, 252).

values in the range 0-127. The fourth group consists of parametric values expressed in the hexadecimal system, which is suitable for real-time implementation as this system corresponds to the potentiometers of the controllers. This can therefore form a concrete tool to act as the basis of the composition of parameters, which will be discussed in the next section.

The Aries 300 Music System is used in the composition shown in Figure 8. The diagram is constructed for a unique sound texture, in which the composer requires the prior use of an echo as a trigger and two control pedals. This graph, as pictographic information, has a precise function in the composition. The relationships of all the components and their connections make the interpretation of this composition possible. The whole work consists of several different diagrams, which represent its different phases. Thus, diagrams as a tool to composing parameters can be applied to larger parts of the composition of parameters through this example. However, it is necessary to define the required time, which is a key factor for the possible realization of the composition of parameters. Without such precise technical diagrams the realization of the composition within electronic media would not be possible. Thus, the diagram of connections, or connections of components, as well as the direction of signal flow is imperative for composing parameters. By describing the connections between the components and their orientations, it is possible for the composition of the parameters to follow. In the next section I will present a newer composition that applies the previous diagrams and, finally, a specific composition of parameters.

Rawlinson (Figure 9) composes parameters which are like instruments and are nomenclaturally organized into the score. In addition to this parametric organization, the composer uses time patterns marked at the top of the score. The composition is performed by one performer who has precise markings or notated gestures. With simple and sparse notation, it is possible to regulate all parameters. This composition is performed via tablets and, in addition to the explanations in the legend, the composer can add pictographic marks and their descriptions. The systematic approach to the compositional material allows the musical notation to be simple and noticeable, enabling the quick reactions of the performer. For any parameters that need explanation it is possible to apply this systematization directly to the legend. The legend must contain primarily a clear picture of the system being operated, the modules of the individual systems, and the notation of the parameters contained in the specific musical synthesis of the sound operated by the musical composition. The musical composition should control the system of electronic musical syntheses (unless for the purposes of experimentation) If there are several synthesizers present then it is necessary to emphasize their connections.

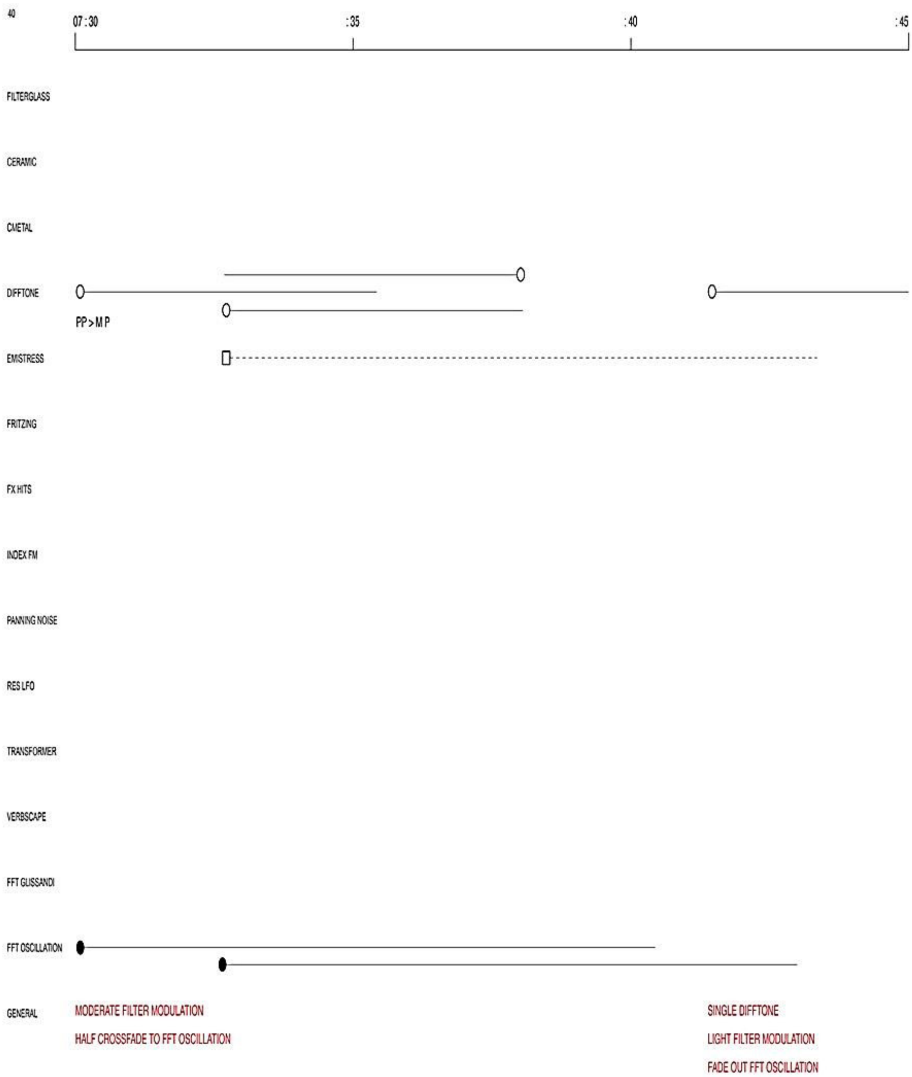

Figure 9. *Short Circuit* by J. Rawlinson (Rawlinson 2011, 40).

2. ARGN, POSSIBLE COMPOSITION OF PARAMETERS FOR ELECTRONIC MUSIC

Approximate Reductionist Graphic Notation, (ARGN) is a flexible deterministic music notation system that allows for applications of all determined procedures of sketching, designing, creating, and realizing both sound and composition with musical text. To understand this concept, it is useful to explain and connect the four words of the acronym. 'Approximate' as it enables the simplicity of the information space which is limited to the basic boundary points. This space is ruled by the performer and only the performer determines in the approximate description of the score which value he or she takes, allowing for fast interactions with the flow of information. At the same time, performers are given space to perform better in the barriers of interpretive art rather than being presented with burdening information. This approach is imprecise, but it refers to the individual as a composer and thus achieves a more direct relationship to the work, or rather to the score, which is no longer just a set of rules but a source of possibilities and probabilities. The notion of inaccuracy should be better defined as a space of individual versus collective precision. So one can go a step further and realize that precision is a collective and unified virtue. This system offers unified imprecise precision because precision itself is only a quantization of time patterns.

‘Reductionism', as another factor necessary for approximation, can be defined as a way of accessing written information. So the information is not only approximate but at the same time reduced to a minimum. This approach offers only reference points as a landmark in some unknown space, as coordinates. If you take a basic course that contains two known points (the start point and the end point), then it is easy to get to the destination. Everything that happens within these parameters or between them is a determination that belongs to the domain of time determinations, and the system of notation or written text itself has no purpose. The reason for this is the huge number of time variables that do not need to be managed, because things in that amount of possibilities and probabilities must be allowed and tolerated. Only in the way of defining waypoints with minimal time determinations can a music flow be realized in all situations more easily than with precise time instructions, as is the case in most musical scores. Reductionism does not refer to the denial of information but to the freedom of movement in the information network. Thanks to this approach, the interpreter can solve any situation present in the variables of time determinants, because the reduction actually forces them to carefully adjust to the time. Thus, reduction is related to the parameter of time and deals with its performances, which it does not overcome, does not anticipate, does not annul, but consonants with.

The 'Graphic' approach to notation has been known for a very long time. This third factor of ARGN achieves the unification of approximation and reduction. Thanks to the approximation, the graphic data is parametrically determined with the basic space, placed by reduction as an object in time space and not as an object with time determinants of size or duration, and the shape itself is reduced to a recognizable model in the score. This recognizability of the model is a graphical approach to notation which identifies the intention of the composer in real time.

Ultimately, the purpose that unites all three of these aspects is 'Notation'. Notation is a determinant of function and not purpose, so it itself acts as an equal with approximation, reduction, and a graphical approach. Therefore, this word is not at the beginning of the acronym but at the end, so that it would not have a primary function but a proportional value with ARG in the ARGN system.

Purpose of ARGN

All four approaches allow for much more than a quick reaction of the performer to the music text or for the ease of recognizing a music model or even the duration of information in time, which is visually clear but not limited to values, and thus creates security and willingness to react in time. Yes, essentially this notation platform makes a musician an artist and a composer, not merely an operator or technician. This idea actually has its roots in the author's RMC (Reductional Music Complexity) system which is designed for this purpose, but is more complex for performers than ARGN, as the time frame is more precise as well as the precision and complexity of rhythmic processes, which leads the performer to research before confronting composition. Why is it that this notation asks the interpreter for something more? Because the performer does not change the text in relation to unpredictable weather determinants such as the atmosphere of the audience, the temperature in the hall, the size and type of space where the concert takes place and the like. Another reason for this is the adaptation of the musical text to the person or the performer, this idea is not actually present in other deterministic notation systems. This factor makes a musician a researcher and a discoverer, but in real time. This is what actually makes freedom, that is, one's own relationship with time through artistic realization. Finally, this approach leads to a “pure” individual mimetic transfer of human imagination and energy to music. Pure, because few factors, parameters, or elements are represented in the mediator, or musical score (ARGN), between the artist and the performance. Yes, ARGN like any other notation system is an intermediary between artists (composers and performers) and performance. Finally, this notation basis is for electronic instruments because they contain a huge potential that also carries a large amount of information, so the necessity of such a system has emerged. Big information is not practical for performers. Information that programs and performs something is difficult to combine because it is not inherent in music. In contemporary artistic music practice, performers are expected to have a practical readiness and knowledge of the use of extended techniques of playing instruments. It would be very difficult to ask the same performer to tune, change, and compose instruments in real time while performing the work. In electronic music there is much more than the above due to the potential of modulation and parametrics, and it is not possible to ask the performer to alter their precision in the performance of works that contain these great possibilities in making and shaping sound.

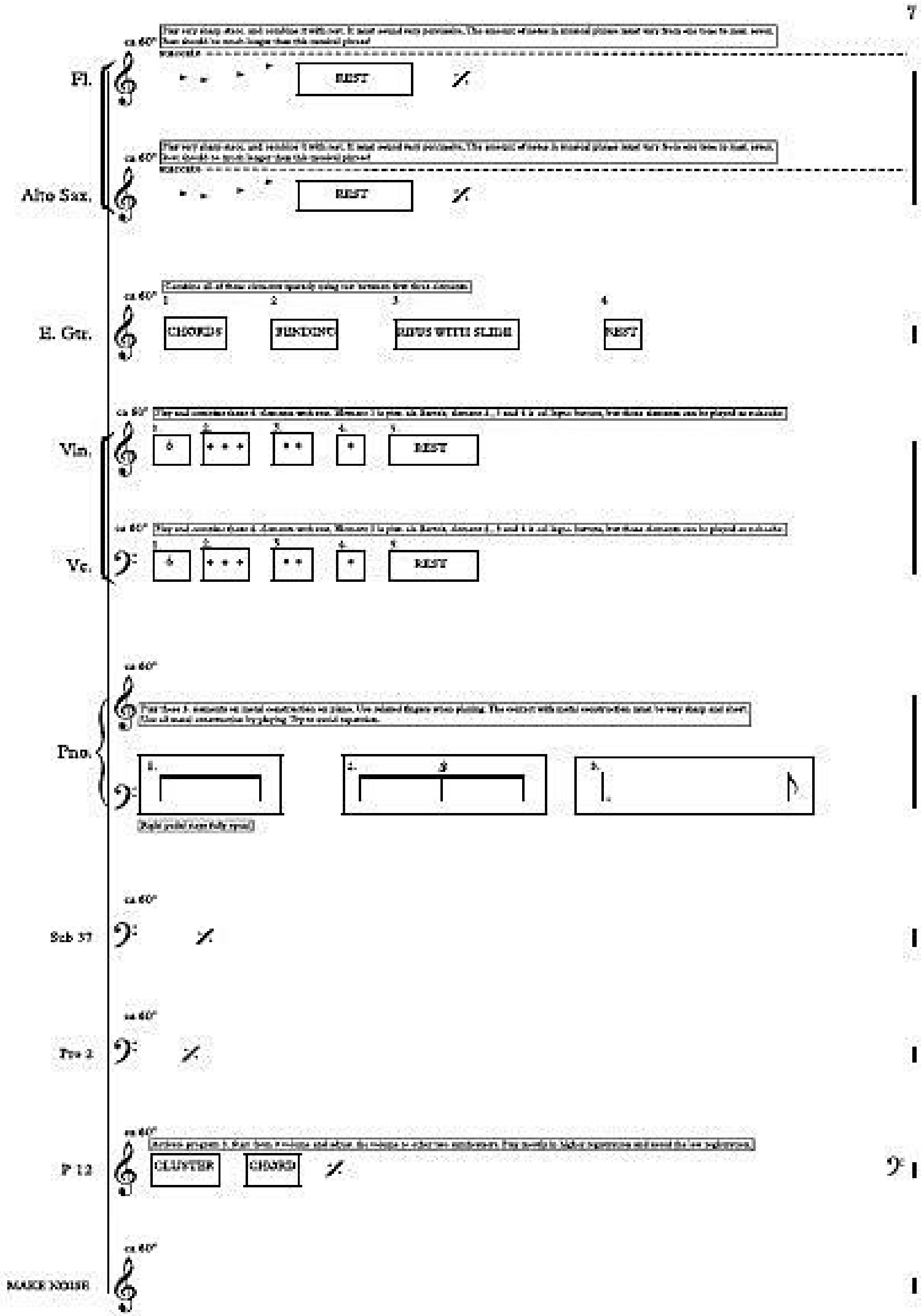

Figure 10. *Subtractive study for sound synthesizers and ensemble* by D. Rešidbegović (Rešidbegović 2016, 7).

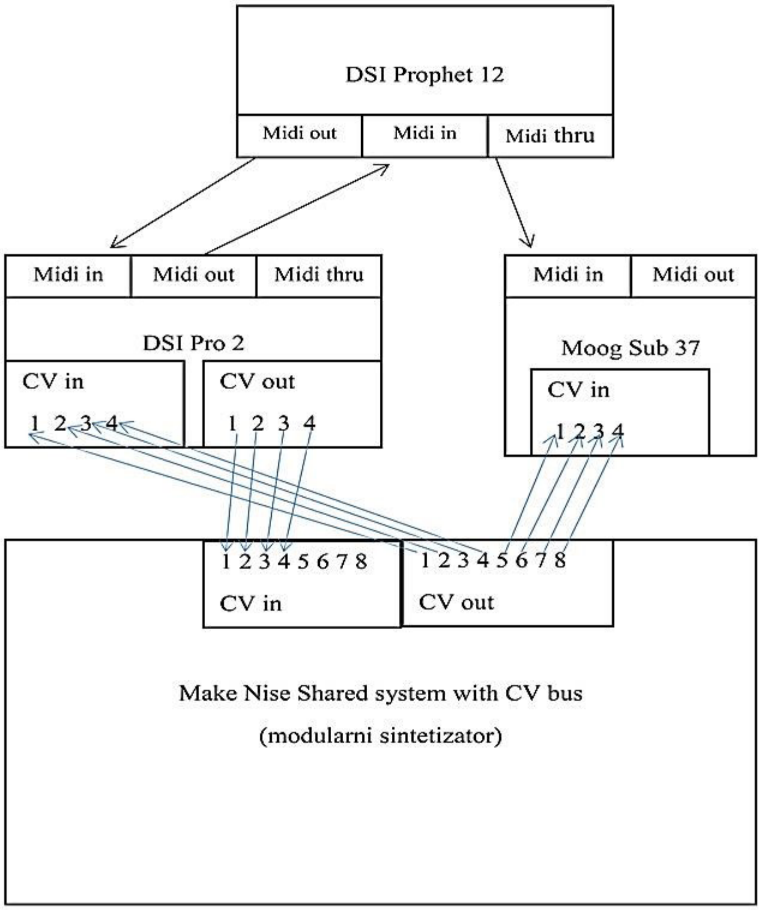

Figure 11. Hybrid system. An example of a composition legend for subtractive sound synthesizers.

Practical approach to composition and notation through ARGN

Figure 11 shows a system consisting of digital connections connected via MIDIA and analog via voltage control (CV). The system consists of hybrid synthesizers DSI Prophet 12 and Pro 2, and analog Moog sub 37 and Make Noise Shares system with CV bus. Of these synthesizers, Make Noise is an analog modular system, which is controlled by voltage control. It is necessary to point out here the connections with external components and audio signal outputs.

Figure 12, in addition to a clear picture of the output channels, also gives the disposition of the synthesizer ratio. As can be assumed, everything is adapted to one interpreter who is centrally positioned in relation to the instrumentation. Similar dispositions can be found in different works written for percussion instruments or Multi percussion, which implies that one performer operates with multiple instruments.

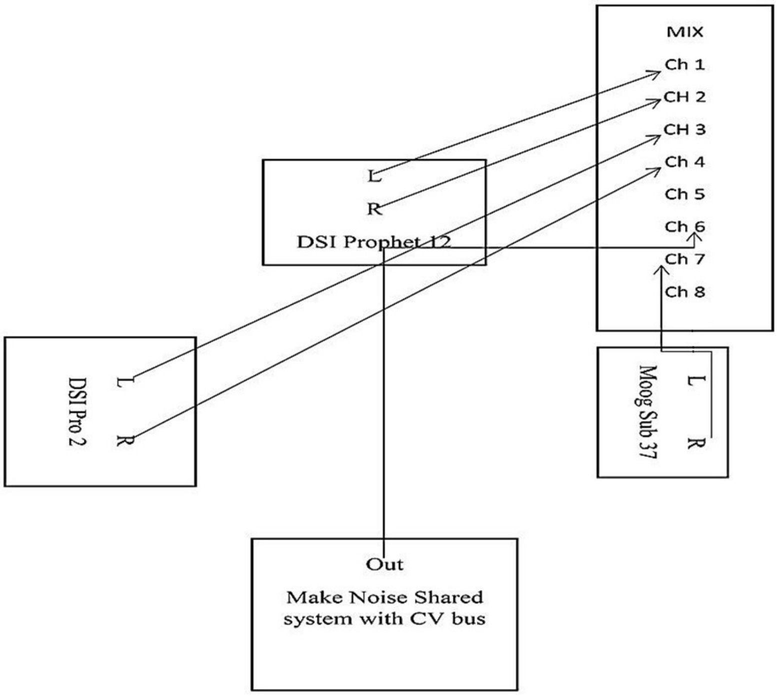

Figure 12. Output channel layout diagram.

Figure 13 represents an external component in the aforementioned system. This system uses only one external controller which, as can be seen in the graph, is a sound amplitude control pedal. After clearly defining the relationships, dispositions, external controllers, it is necessary to define the initial settings of the internal connections of the components of individual synthesizers.

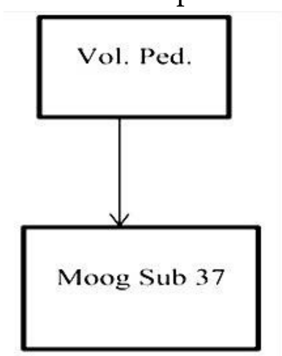

Figure 13. Volume Pedal is an external controller for Moog Sub 37.

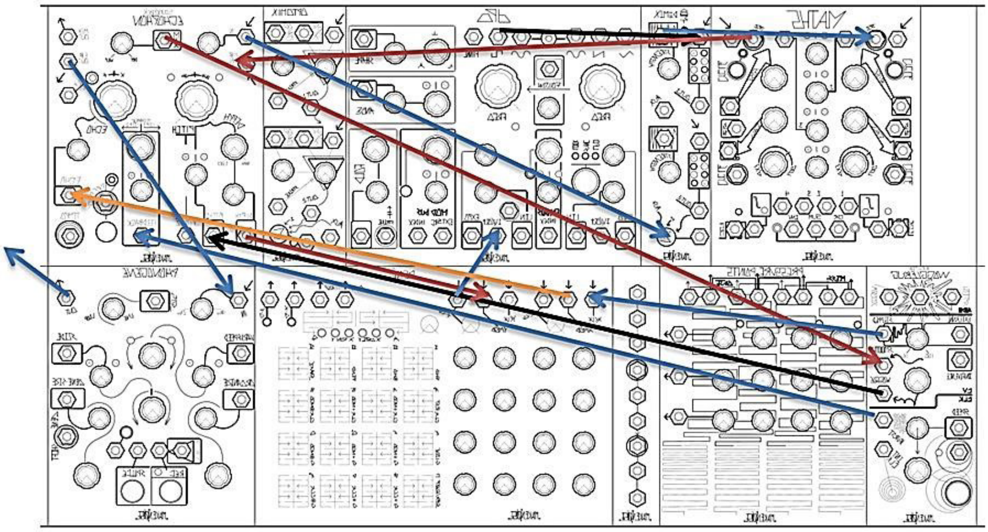

Figure 14. Make Noise diagram. Diagram for modular synthesizer patch.

Figure 14 shows the initial composed sound. The parameter values are set to 12h, which indicates the possibility of changes in the musical score, while the initial sound remains open for future transformations. The parameter based on the hexadecimal system corresponds to the synthesis of the previously mentioned scales values. This system corresponds to the synthesis of MIDI and percentage values. The author of this article classified and included the hexadecimal system as a possibility of musical notation of parameters in order to achieve fast visual stimulation in the case of live performances. This system may not be the most accurate, but the advantages it offers are efficiency in reaction during the performance, due to its reliance on approximate values. Approximate values can be read and realized instantly, while precise values take time to identify and realize which creates a problem with live performances. The graphic representation in Figure 13 demonstrates the setting of conditions for the production and initial realization of the composed sound. The initial position of the parameters can also be determined in the score for other instruments, but since these are non-modular synthesizers, it is possible to mark the beginning with the initial patch, which actually indicates the basic connection on the sound synthesizer. It is the basic connection of an oscillator with an open low-pass filter and an amplifier. Another way to achieve the initial patch is to indicate the wave, letters or mark, the openness of the low-pass or high-pass filter and the parameter of the sustain in the amplifier modulator, i.e. the amplitude envelope generator. The sound envelope amplitude generator must be activated to produce sound, unlike other modulators that are deactivated (their activation is not critical in the sound production itself). The magnitude of the value of the mentioned parameter (sustain) determines the strength of the amplifier. In a musical score, it is possible to note these elementary parameters for all sound synthesizers via this simple system because of the compatibility due to the function of the basic parameters of musical sound syntheses. Therefore, the elementary parameters can be represented regardless of the instrument or program through which the work is performed.

Prophet 12 initial patch,

Pro 2 initial patch + seq mod. cut-off low-pass filter 16T,

Moog sub 37 user patch panel -6 dB filter (1 pole filter) + resonance 12h, vol. ped. control decay ADSR (Amp EG) AMP.

These designations, which are standardized abbreviations in English, mean that the Prophet 12 uses a factory-programmed initial sound as well as the Pro 2 which still uses a step sequencer in sixteenth note triplets (semiquaver triplets) values to modulate the LP filter cut-off. This sequencer modulates the opening and closing of the low-pass filter cut-off. Finally, the Moog sub 37 uses the initial factory sound located on this instrument under the user group, and is based on a type of single-pole low-pass filter that has a drop of -6 dB per octave. In addition to this setting, the Moog Sub 37 is controlled by a CV (Voltage Control) pedal that is set to control the decay function of Amp EG in this synthesizer. In this way the Moog synthesizer can later use modulations using an internal step sequencer, which can be defined as modulations of articulations in music, as it would modulate the decay of Amp EG. A special graph can highlight all the described functions.

As can be seen in Figure 15, it is possible to use deterministic bonds that have zero values of modulation quantities (Amount). These quantities are provided for performance, so that the real-time modulation operation can be performed. After the highlighted connections, it is necessary to mark another important parameter in the score, which synchronizes the metronomic values of this connected system via MIDI. It is enough to indicate this with the text: Master clock 120 bpm, MIDI clock synchronization Prophet 12, Pro 2 and Moog sub 37, which defines clear synchronization via MIDI. The composer can later write in the musical score all the modulations that are not marked in the legend. Such modulations require sufficient time for implementation. Therefore, it is necessary to leave enough time for the interpreter, so that the interpreter sets all the necessary parametric values in time. This type of modulation represents a development from the initial or determined modulations that are in the legend of the musical score. The notation of such modulations needs a clear graphical representation which, again, would not harm the clarity of a simple musical text. The system of such marking must be equal to the previous deterministic table system, which is shown in Figure 14. Of course, if it is a much simpler operational setup, then it is enough to indicate the source, target, and amount of modulation in the text. The source, destination, and amount of modulation is the basis of any modulation. Therefore, the basis can be displayed in any musical score because it contains a universal principle that does not require the translation of values or names of controllers or parameters. These values can be used to explain the intent for realization required to shape the modulation.

Pophet 12 Initial Pitch			
Osc1 saw	Osc 2 saw	Osc 3 saw	Osc 4 saw
Tune 0 Freq c1	Tune -3 Freq c1	Tune -5 Freq c1	Tune +2 Freq c1
LFO 1 S&H AMT 0 dest Osc 1 freq LFO Rate 0	LFO 2 S&H AMT 0 dest Osc 2 freq LFO Rate 0	LFO 3 S&H AMT 0 dest Osc 3 freq LFO Rate 0	LFO 4 S&H AMT 0 dest Osc 4 freq LFO Rate 0
Low-pass -24 db cut-off 100%	Hi-pass -12 db Cut-off 0%	Filter ADSR KB Cont 0 A0 D0 S0 R0	AMP ADSR A0 D0 S70% R0

Pro 2 Initial Pitch			
Osc1 sqr	Osc 2 sqr	Osc 3 sqr	Osc 4 sqr
Tune 0 Freq c0	Tune 0 Freq c0	Tune 0 Freq c0	Tune 0 Freq c0
LFO 1 sin AMT 0 dest puls width osc1 LFO Rate 0	LFO 2 1 sin AMT 0 dest puls width osc1 LFO Rate 0	LFO 3 1 sin AMT 0 dest puls width osc1 LFO Rate 0	LFO 4 1 sin AMT 0 dest puls width osc1 LFO Rate 0
Low-pass -24 db cut-off 100%	Filter 2 State Variable Notch cut-off 40%	Filter1/2 ADSR KB Cont 0 A0 D0 S0 R0	AMP ADSR A0 D0 S70% R0
Seq 16 step dest low-pass filter ch 2 clock dev 16T cut-off AMT 0	-	-	-
1CV in Make Noise CV to Feedback tune AMT 0	2CV in Make Noise CV to Feedback time AMT 0	3CV in Make Noise CV to Dist AMT 0	4CV in Make Noise CV to All Amp ADSR Release AMT 0
1CV out in Make Noise Math Trg AMT 0	2CV out in Make Noise Phonogene Vari-speed AMT 0	3CV out in Make Noise Rene Y mod AMT 0	4CV out in Make Noise Echophone Pitch 2 AMT 0

Moog sub 37 User Pitch (Initial Pitch) Panel			
Osc 1 saw/sqr	Osc 2 saw/sqr	-	-
Tune -2 Freq c2	Tune +1 Freq c2	-	-
LFO 1 tri AMT 0 dest wave shape osc1 LFO Rate 0	LFO 2 S&H AMT 0 dest wave shape osc2 LFO Rate 0	-	-
Low-pass -6 db cut-off 100% resonance 12h	Filter1/2 ADSR KB Cont 0 A0 D0 S0 R0	AMP ADSR A0 D0 S70% R0	
1CV in Make Noise CV Cont. Glide AMT 0	2CV in Make Noise CV Cont. Filter resonance AMT 0	3CV in Make Noise CV Cont. LFO 1 Rate	4CV in Make Noise CV Cont. LFO 2 Shape

Figure 15. Table of basic parameter settings.

As Figure 16 demonstrates, the composition of the parameters requires previously written concise instructions. Without previous explanations, this musical image would not be possible. Marked time windows accommodate the actions required to implement parameter changes in the score The specific notation for electronic instruments or for computers, the ARGN, is defined by the author of this text. This type of notation is related to the author's previous work based on the realization of compositions using the basic musical parameter or rhythm without pitch. The very principle of rhythmic musical composition is based on the idea of reductionist complexity present in computer science, which is part of the mathematical probability

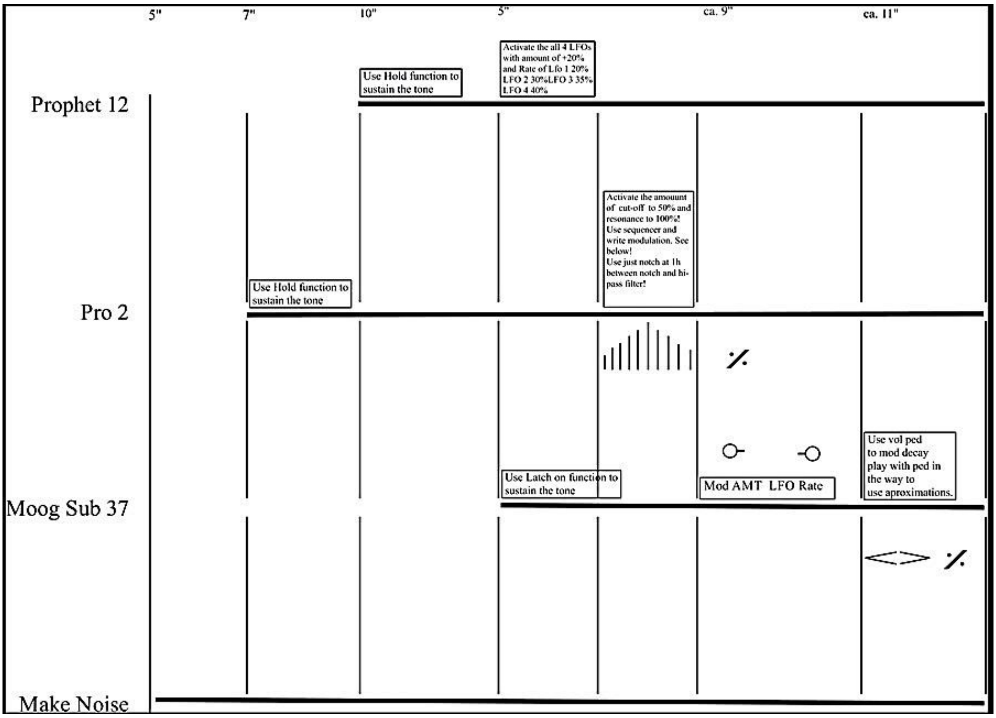

Figure 16. Demonstration of the author 's composition based on the parameters of subtractive musical synthesis.

theory. Thus, the author's basic basis arises from his RMC theory, which is actually a control deterministic model of musical flows in a composition. Tone pitches are left to the performer's choice. If the composer wants to explain the registration, it is possible to define it with a key. The author connects to the RMC system an approach to approximate value in order to achieve a better musical image in the musical score. The idea is to unify the text itself by something that can be universally translated, whether into acoustic, electroacoustic or electronic instruments, including a computer. The unification that is present in the ARGN system refers to the most important link that unites all systems and in a way merges them into one meta system of understanding music information. As mentioned earlier, the basis is taken from the RMC system by which a musical or instrumental gesture can be established, but the most important thing is actually an interpretive gesture. This gesture always depends on the stimulus of the text itself and that is why the author takes ARGN as a universal system of stimuli of performers who act more on the image than on the symbols and therefore the approximation itself is of great importance. The whole value system is approximate, which is also the basis for modulations, so the performer becomes both a sound architect and a composer of interpretation, which is also the author's starting point in his RMC system. The role of the composer himself is a meta-construct of the work that has unlimited potential because it has an approximate basis and at the same time enables endless interpretations of one composition, as well as a basis for interpretive research by performers and scientists. In this meta system, everyone involved in a work must approach it as a composer in order to enter analytics or performance. Approximation is necessary, because different instruments and synthesizers react differently to the parameter due to the individual architecture of the sound signal and the arrangement of the components. The second argument to the approximate approach is the meaning of modulation. The modulations themselves represent constant changes. These changes, as variable values, are approximate rather than fixed. In some modulations there are fixed values which need to be defined by specific parameter units. These modulations belong to a smaller group compared to the previously mentioned ones. This second group is related to simple modulations, which with their sources, destinations, and the amount of modulators form a much smaller group compared to complex modulations. An example of a necessarily defined parameter value is beat frequency modulation. In this modulation, it is necessary to denote the precise parametric values of the oscillator, whose frequency deviates from the frequency of the adjacent oscillator, and thus makes the mentioned effect. In addition to this example, it is possible to cite a number of other examples of simple modulations such as a thriller simulation, which must be clearly defined beforehand. Therefore, it should be borne in mind that these types of modulation should be clearly marked in relation to their values. Every conceptually conceived modulation requires an experimental method (Čavlović 2012, 132). The modulation is previously sketched so its realization is approached with a computer or a sound synthesizer, which proves an experiment on the basis of some of the musical syntheses. This approach is the basis for composing parameters in different or combined sound syntheses suitable for musical composition. What defines this method is a controlled, assumption-constructed, laboratory experiment. Thus, computers and sound synthesizers are a laboratory, that is, a music laboratory, which enables laboratory observations of the behavior of sound in relation to its, presumably constructed, composition of parameters. Musical composition has always contained this method, because the composer who composes assumes, or sets up a theory, which he realizes with the help of instruments to make an experiment. This old approach to the compositional profession and practice has not changed and remains the same today. In the past, there have been revisions of scores, proving the method of experimentation. Different publishing houses make reissues of notes by composers who have not been alive for a long time, outlining the dynamics of this method. Clear revisions of compositions for keyboard instruments by J. S. Bach during his lifetime and to the present day, explain and argue this thesis (see Schulenberg 2006, VI, 4, 7, 38, 73-74, 98-99, 118, 146, 148, 164).

Summary

Essentially, ARGN represents the composition of parameters. The composition of the parameters of musical sound syntheses is present in the content of the legend, which contains tables of all parameter values necessary for the realization of the composition. This approach provides the basis for the composed sound that occurs throughout the work. Each composed sound is created through the systematization of the parameters of musical sound syntheses, which consists of all their components and parameters. The experimental method makes it possible to compose sound because it uses a computer or a sound synthesizer as a laboratory for controlled experiments that have been previously sketched or designed. Composition by electronic means offers simple and practical notation examples with dynamic and original changes of sound colors through composed parameters.

The big problem of notation today is its purpose. Nowadays, notation is no longer the only information, because the recording itself gives even more precise information than written notes as it contains a live recording in which there is not only musical information but also interpretation. Thus, the very need for a notation system is not directed towards information that remains for future times, but is related to the art of interpretation and musical composition. Due to these reasons, notation in the domains of more complex systems in electroacoustic and electronic music has not been partially or completely notated recently as its realization is almost impossible. However, what is lost is a legacy for performers and performances, because the performance still exists, just not all from a recording. That is why the ARGN system is intended for live electronics, which can be with or without acoustic or electro-acoustic instruments. It is also a human legacy of written and performed music of the past, but only with intention and not with means and functionality. This notation system makes a musical composition an artistic and scientific field with the ability to create artifacts, through sounds without any instruments, which can be (in the field of a musical composition) a musical text, musical content, or a musical score.

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Article received: May 12, 2020
Article accepted: June 5, 2020
Original scientific paper