

# ALGORITHMIC COMPOSITION FOR CLASSICAL GUITAR EQUIPPED WITH MIDI PICKUP

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## History

### 1.1 HISTORICAL INTRODUCTION: THE EMERGENCE OF THE HEXAPHONIC PICKUP

The hexaphonic pickup captures each string independently, enabling new possibilities for digital interaction.

### 1.2 THE PIEZOELECTRIC TRANSDUCER

Piezoelectric transducers convert string vibrations into electrical signals with high accuracy and natural sound.

### 1.3 THE ROLE OF THE PICKUP IN PITCH-TO-MIDI CONVERSION

Independent string detection improves tracking accuracy, dynamics response, and real-time MIDI performance.

### 1.4 HEXAPHONIC MIDI PICKUP WITH GTM-6 SYSTEM

The GTM-6 system processes six strings independently, pioneering MIDI integration for guitars.

### 1.5 GK-2 HEXAPHONIC PICKUP AND 13-PIN INTERFACE

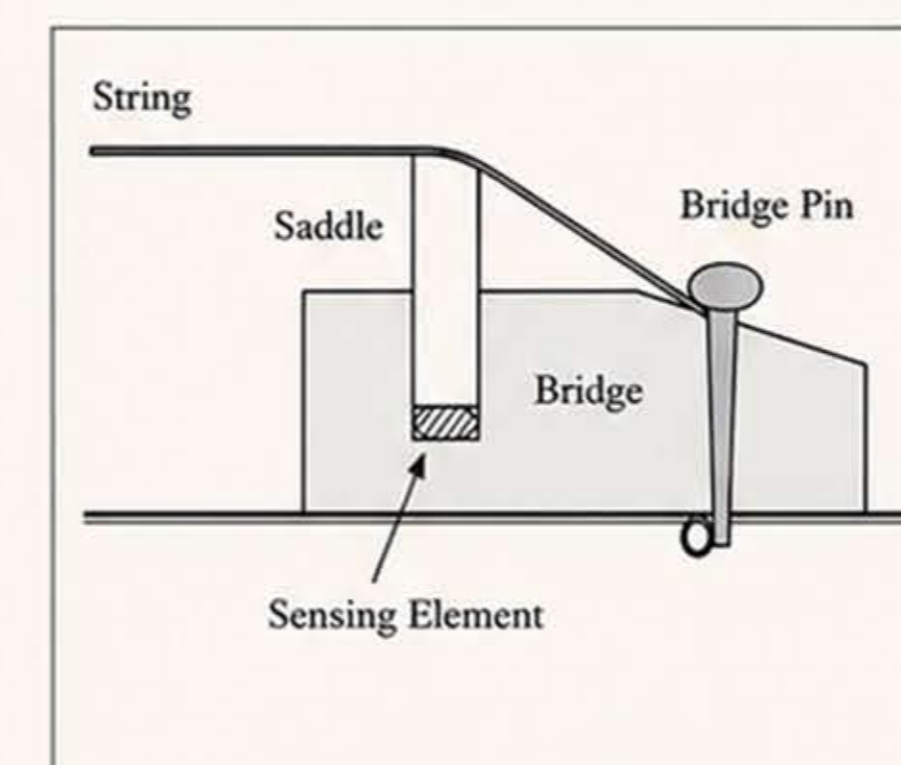
The GK-2 with 13-pin interface became a standard for reliable guitar-to-MIDI communication and wide system compatibility.



## 2. LUTHERIE AND MIDI DEVICES

### 2.1 CLASSICAL GUITAR LUTHERIE WITH INTEGRATED MIDI PICKUP

The integration of a piezoelectric pickup into the classical guitar preserves the acoustic characteristics of the instrument while enabling accurate string-by-string signal detection for MIDI applications.



### 2.2 THE RMC POLYDRIVE SYSTEM

The RMC Polydrive system provides individual control over each string signal. It includes independent volume, tone and synthesis controls, offering great flexibility in shaping the guitar sound before MIDI conversion.



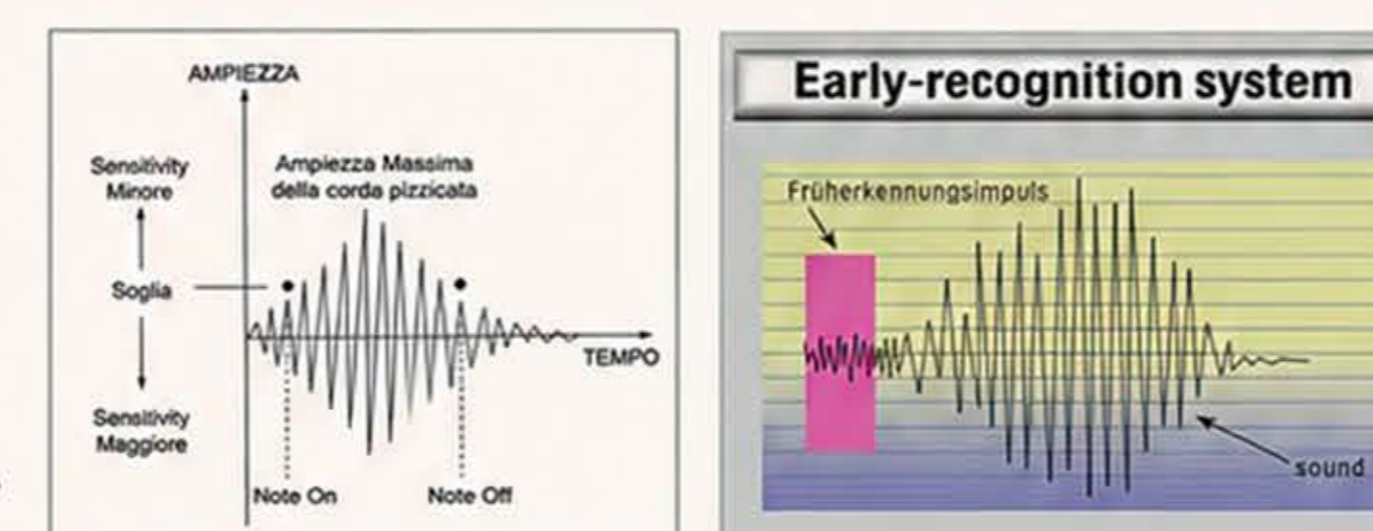
### 2.3 ROLAND CONVERTERS: BOSS SY-1000 AND BOSS GM-800

The BOSS SY-1000 synthesizer and BOSS GM-800 MIDI converter offer advanced processing, high tracking accuracy and extensive sound design capabilities, making them ideal tools for guitar-to-MIDI performance and composition.



### 2.4 LATENCY TEST

Latency tests are essential to evaluate the response time of the guitar-to-MIDI system. Accurate measurement ensures optimal synchronization between performance and digital sound generation.



## 3. MIDI AND LIVE ELECTRONICS

### 3.1 The MIDI System in Algorithmic Music: Hardware and Software »

The MIDI (Musical Instrument Digital Interface) system enables communication between musical instruments, electronic devices and computers.

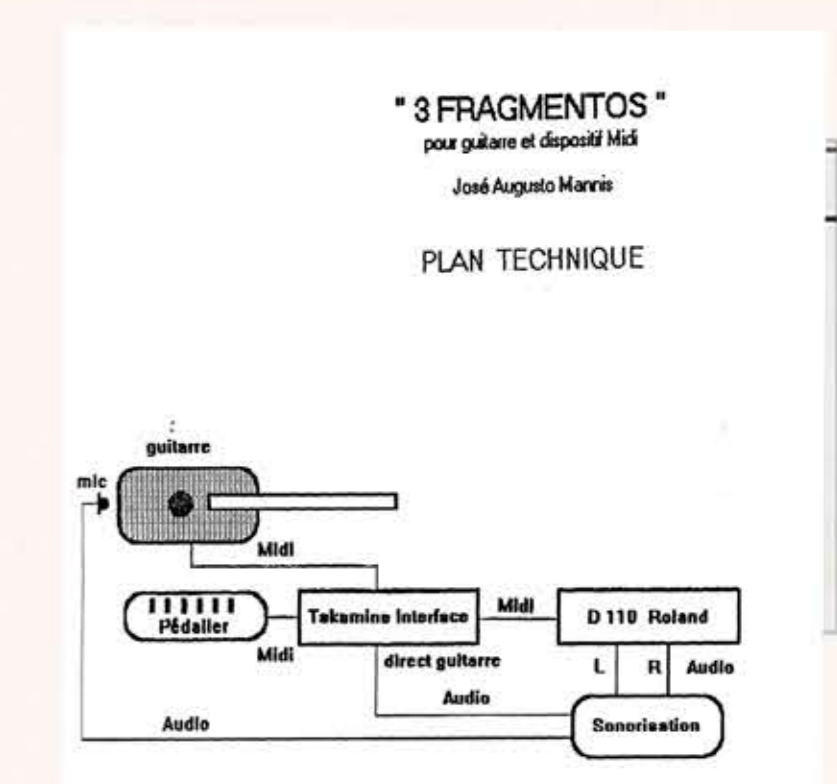
- Hardware: MIDI instruments, interfaces, converters.
- Software: sequencers, synthesizers, algorithmic environments.
- MIDI data: notes, velocity, control changes, program changes.

Parameter	Description
output	the generated audio signal
amplitude	the volume (envelope)
freq/2	base frequency — the pitch, one octave lower
carrier ratio	multiplier of the audible freq.
modulator ratio	here C.M = 1.1
modulation index	how bright the timbre is
wave table	the base shape (1000 = sine)

### 3.2 Works for Guitar with MIDI Instrumentation »

Contemporary compositions exploit MIDI guitar to integrate acoustic performance and digital sound processing in real time.

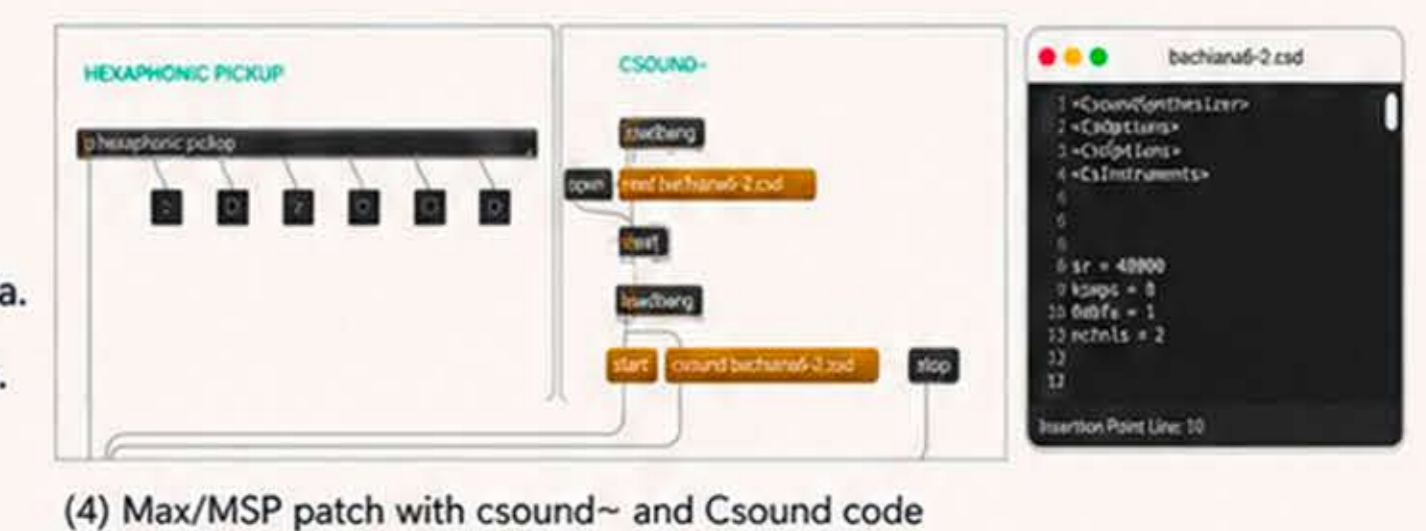
- Extended techniques and alternative tunings.
- Real-time control of synthesizers and effects.
- Integration of acoustic and electronic sound environments.



### 3.3 The Csound~ Environment with csound~ Object and Max/MSP »

Csound~ in Max/MSP allows real-time algorithmic sound synthesis and processing controlled by MIDI data.

- csound~ object: executes Csound code in real time.
- Max/MSP: graphical environment for interaction and control.
- Ideal for live electronics and algorithmic composition.



### 3.4 Stefano Petrarca composition of MIDI Guitar, SY 1000 e Csound~ »

The composition "Il giardino di Goldbach" (2026) combines MIDI guitar (Roland SY-1000) and the Csound~ environment for live electronics.

- Algorithmic generation of musical material.
- Real-time processing and spatialization.
- Interaction between performer and computer.

```

<CsoundSynthesizer>
<CsoundOptions>
</CsoundOptions>
<CsoundInstruments>
sr = 48000
krngp = 8
kbufs = 1
nchnls = 2
gfn ftgen 0,0,257,9,.5,1,270 : define a sigmoid, or better
messign 1,301 ;strum. 301 assegnato al canale 1
messign 2,302 ;strum. 302 assegnato al canale 2
messign 3,303 ;strum. 303 assegnato al canale 3
messign 4,304 ;strum. 304 assegnato al canale 4
messign 5,305 ;strum. 305 assegnato al canale 5
messign 6,306 ;strum. 306 assegnato al canale 6
    
```

- Notes
- (1) Score excerpt from "Il giardino di Goldbach (bachiana elettrica 6)", for classical guitar and computer.
  - (2) Example of Foscil opcode parameters in Csound.
  - (3) Early-recognition system for transient detection.
  - (4) Max/MSP patch integrating csound~ and Csound code.
  - (5) Excerpt from the Csound code used in the composition.



REFERENCE

[HTTPS://WWW.FRANCESCOCUOGHI.IT/DENVER/DENVER\\_EN.HTM](https://www.francescocuoghi.it/denver/denver_en.htm)