

MUSICAL COMPOSITION BASED ON CONSTRAINT PROGRAMMING

COULD YOUR FAVORITE ROCK BAND CREATE
MUSIC WITH THE HELP OF A COMPUTER ?

A Master thesis
in collaboration
with

ircam
Centre
Pompidou



Introduction

Composing music starts with your musical ideas. But expressing those ideas as a coherent musical score is difficult and tedious.

The goal of our project is to make a tool to generate a musical score from musical ideas. The composers can express their musical ideas in an easy-to use interface and the tool will generate the musical score.

Theory

Music theory has a lot of permissive rules that can be separated between the three pillars of music : Rhythm, Melody and Harmony.

In our tool, the composer can choose which rule they want to apply to their score, then the tool will calculate solutions matching those requests.

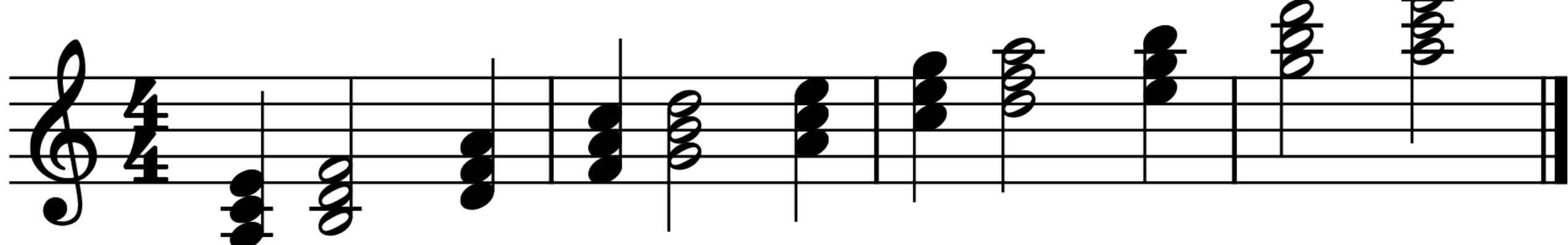
For example, the composer can require a suite of chords that are :

1. Consonant
2. Triads of notes
3. Strictly ascending

And the tool will return solutions such as



Or more complicated



Express
musical
ideas as
constraints

With an
intuitive
interface

Solve
them using
GECODE
and GiL

Get
feedback
from a
composer

Main task

We will develop a software tool to help a composer create music in the style of popular Rock songs.

Musical composition is a very large domain. That is why we have chosen Rock music to make our work tractable. This music style has two upsides :

- First, it has a coherent harmonic structure
- Second, it is interesting to a wide audience.

Our tool will be based on constraint formalization of Rock music that is derived from the musical analysis done in the Ph.D. dissertation of Drew Nobile. This analysis focuses on Rock hits during the period from 1960 to 1990.

Second Task

We will develop an improved user interface to help a composer express their musical ideas.

The goal is that the composer does not need to be a computer programmer but can stay completely in the world of musical ideas.

Our interface will help bridge the gap between the composer and the constraint solver, which is very technical.



“Music is the universal language of mankind.”
Henry Wadsworth Longfellow

Bibliography documents :

- Drew F. Nobile. A Structural Approach to the Analysis of Rock Music. Ph.D. dissertation, City University of New York, 2014.
- Thibault Wafflard. A Constraint Formalization of Counterpoint from Johan Joseph Fux's Gradus Ad Parnassum. Master's thesis, Université Catholique de Louvain, January 2023 (to appear).

Bibliography softwares :

- OpenMusic: visual composer workbench developed at IRCAM.
- Gecode: advanced constraint solver.
- GiL (Baptiste Lapière): interface between OpenMusic and Gecode.
- Melodizer 1.0 (Damien Sprockeels): generating variations on a given theme.
- Melodizer 2.0 (Clément Chardon, Amaury Diels, Federico Gobbi): supporting polyphony, rhythm and pitch.