

Stellar Resonance for Cello and Piano

5 graphical scores by the Mandelbrot's mapping

This music is composed for cello and piano based on a beautiful mathematical function Mandelbrot's mapping. I developed the original computer program to calculate the nonlinear mapping of the Mandelbrot set to determine the timing, pitch, and duration of the notes. The variation of score depends on the initial value of calculation. As shown by the colored (e.g., red and yellow) lines in the following figure, the output values are calculated recursively and depend on the initial parameters. I mapped these successive values on the score as a graphic score. However, I did not simply put the calculated notes on the score directly. I ran the program many times while changing the parameters of the Mandelbrot set to calculate lots of sets of notes, and selected only agreeable and beautiful notes to this piece carefully. The titles of each movements mean the initial values of Mandelbrot's mapping used to calculation the consecutive notes.

Instruction:

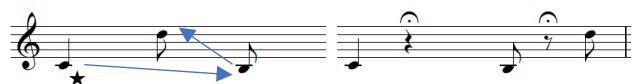
Start from the sign ★ and play next to next according to the arrows; the music does not move left to right and the horizontal axis means the volume. Arrow under the score indicates the range of volume.

Timing of note depends on the distance between two notes and tempo.

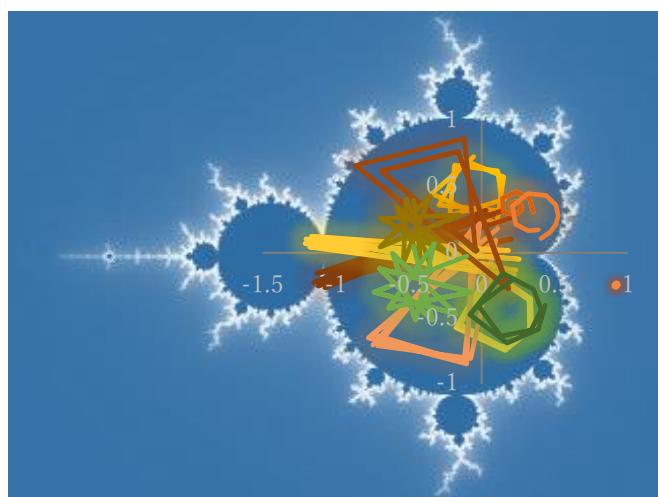
Duration of note depends on the tempo and repeat (about 6 - 9 min).

Repeat times depends on player's choice.

example



written score ➡ actual performance



Mandelbrot set and mapped values using original program

I. value = $-1.2+0.12i$ and $0.313+0.067i$

Violoncello $\text{♩} = 48$ $-1.2+0.12i$

pp *p* *mp* *mf* *f* *pizz.*

Piano $\text{♩} = 48$ $0.313+0.067i$

mf *pp* *mp*

Piano : Repeat 3 ~ 5 times (until cello finishes, ad lib.)

II. value = $-0.073+0.823i$ and $-0.12+0.87i$

$\text{♩} = 36$ $-0.073+0.823i$

Violoncello

pizz. *(arco)* *pizz.*

ff \leftarrow \rightarrow *pp* *col legno*

Piano

$-0.12+0.87i$

p \leftarrow \rightarrow *f*

vib. *vib.* *vib.*

* vib. = vibrato : during pushing key, shake the palm up und down.

III. value = $-1.047+0.247i$ and $0.633+0.347i$

Violoncello

$-1.047-0.247i$

$\text{♩} = 60$

col legno

sul pont.

p \leftarrow \rightarrow *mf* \leftarrow \rightarrow *ppp*

Piano

$0.633+0.347i$

$\text{♩} = 60$

p \leftarrow \rightarrow *mf* \leftarrow \rightarrow *ppp*

vib. *vib.*

* Before performance, push these keys by arms with sostenuto pedal slowly to keep dampers up.

IV. value = $0.19+0.53i$

Repeat 2 ~ 4 times (ad lib.)

$0.19+0.53i$

$\text{♩} = 48$

The image shows a musical score for Piano and Violoncello. The Piano part is written on two staves (treble and bass clefs), and the Violoncello part is written on two staves (treble and bass clefs). The score includes various musical notations such as triplets, dynamics (mf, ff, ppp), and performance instructions like pizz. and sul pont. Blue arrows indicate complex cross-instrument connections between notes in the Piano and Violoncello parts. A star symbol is placed above a note in the Piano part. The score is annotated with the value $0.19+0.53i$ and the instruction 'Repeat 2 ~ 4 times (ad lib.)'. The tempo is marked as $\text{♩} = 48$. The Violoncello part includes markings for pizz. (pizzicato), arco (arco), and sul pont. (sul ponticello). Dynamics are indicated by mf, ff, and ppp. A sf (sforzando) marking is also present. The Piano part includes a triplet marking and a mf dynamic. The Violoncello part includes a triplet marking and a mf dynamic. The score is annotated with the value $0.19+0.53i$ and the instruction 'Repeat 2 ~ 4 times (ad lib.)'. The tempo is marked as $\text{♩} = 48$. The Violoncello part includes markings for pizz. (pizzicato), arco (arco), and sul pont. (sul ponticello). Dynamics are indicated by mf, ff, and ppp. A sf (sforzando) marking is also present. The Piano part includes a triplet marking and a mf dynamic. The Violoncello part includes a triplet marking and a mf dynamic.

V. value = -0.553-0.467i, 0.3+0.193i, 0.36-0.233i

Repeat 6 ~ 9 times (ad lib.)

* Bowing : Repeat with following pedal order.

1st, 4th, 7th time : sul pont.

2nd, 5th, 8th time : frosch

3rd, 6th, 9th time : quasi battuto, col legno

Fast ♩ = 96 ca.

The image shows a musical score for Violoncello and Piano. The Violoncello part is in the upper system, and the Piano part is in the lower system. The Violoncello part consists of two staves, and the Piano part consists of two staves. The score is annotated with red arrows indicating bowing directions and blue arrows indicating pedal directions. A dashed blue line with 'fff' and 'f' indicates a dynamic range. A star symbol is placed above the 7th measure of the Violoncello part and above the 7th measure of the Piano part. The score is for a piece in G major, with a key signature of one sharp (F#) and a time signature of 4/4. The tempo is marked 'Fast' with a quarter note equal to approximately 96 beats per minute. The score is for a piece in G major, with a key signature of one sharp (F#) and a time signature of 4/4. The tempo is marked 'Fast' with a quarter note equal to approximately 96 beats per minute.

* Pedals : Repeat with following pedal order.

1st, 4th, 7th time : senza pedal

2nd, 5th, 8th time : una corda

3rd, 6th, 9th time : sustain pedal