

Rendering a Humanly Unperformable Suite for Guitar

The Guitar Suite is an electroacoustic tape piece, for virtual guitar. It makes use of musical materials that no human guitarist could play, due to their speed of execution, rhythmic complexity and stretched fingering positions. The rendering methods for the Suite vary over the course of the six movements and encompass a recently developed coupled string guitar physical model, SuperCollider code, and a painstakingly prepared sample database. Methodologies are outlined for the composition of musical material, encompassing custom C++ software for generative acceleration canons over the six guitar strings after Conlon Nancarrow, an automatic sample database composer, and work by hand in the score writing program Sibelius to emulate human expression.

The main guitar model is based on the digital waveguide synthesis technique, and includes a guitar body model in a highly coupled structure. It is implemented using the MPEG-4 SAOL language and consists of a score interpreter with player model and a core digital signal processing routine. Renders were undertaken 'overnight' to maximise quality. The model is by no means perfect, and in fact it's inadequacies were exploited to create the prelude to the work, featuring undamped feedback between coupled strings. This movement came about due to instabilities in an earlier draft of the renderer, but the outtakes were seen as a very honest and useful side effect of the compositional process.

The Guitar Suite is the third in a series of compositions, ostensibly for solo instrument, that exceed human performance capabilities and can therefore only exist as computer rendered artworks. This Suite is a collaboration between a computer musician and a physical modelling researcher. The initial compositional material was by the composer working separately, but assistance in rendering, which has surely influenced and modified the composition itself, has come from research into coupled string guitar physical models. In fact, more than one rendering technique is highlighted by the work, with a use of a SuperCollider delayline model, a MIDI sampler solution and in the short but disproportionately hard to build central movement, the database methods of the earlier Suites. The composer therefore got in on the act of synthesis, and the researcher influenced the process of composition, particularly the aforementioned felicitous first movement.

As well as outer through-composed movements constructed by hand, movements three to five are algorithmically composed, the fourth the aforementioned database movement and the third and fifth inspired by Conlon Nancarrow's acceleration canons for player piano, here transplanted to the six voices of the six guitar strings. The central movements take less notice of such constraints on human playing as comfortable or even humanly achievable fingering positions. The more conventionally composed outer movements have psychophysical knowledge painstakingly worked in.

All the movements brought up their own challenges, with often a terrible amount of effort for a small length of rendered time. How the composer might wish to be creative director of his own animation studio, with assistants to help on the laborious chores! Particularly tedious was the writing of scores for six independent guitar strings, so as to challenge timbral differences between strings in the rendering model, and the preparation of the large database for the central interlude (movement four). The piece can be thought of perhaps as a transition work between the database methods highlighted in the earlier part of the series, and the move to the control and rendering issues of composing for physical models.

The Guitar Suite (in six movements) 11'07''

1. **Prelude** 3'19'' [coupled string physical model]
2. **Exhilaration** 1'32'' [cs phy mod]
3. **First Acceleration Canon in six voices after Nancarrow** 1'39''
[sampled guitar vs SuperCollider phy mod]
4. **Impossible Consort** 0'46'' [From a Real Guitar Database]
5. **Second Acceleration Canon in six voices after Nancarrow** 1'39''
[SC phy mod vs cs phy mod vs sampled guitar]
6. **Finale** 2'12'' [cs phy mod]

References

Collins, N (2002) Relating Superhuman Virtuosity to Human Performance. Proceedings of MAXIS, Sheffield, April, 2002.

Nackaerts A., Lauwereins R., De Moor B. Player modeling and control of a physical model of a string instrument. Proc. of the 1st Benelux Workshop on Model Based Processing and Coding of Audio (MPCA-2002), November 15, Leuven, Belgium.

Nackaerts A., De Moor B., Lauwereins R. Measurement of guitar string coupling. Proc. of the International Computer Music Conference (ICMC 2002), Goteborg, Sweden, September 16-21, 2002.

The image displays a musical score for 'The Guitar Suite', consisting of six staves representing different guitar parts: Guit. E, Guit. B, Guit. G, Guit. D, Guit. A, and Guit. E. The score is written in treble clef and includes various musical notations such as time signatures, performance markings (e.g., '11', '10', '9', '3', '5', '6'), and dynamic markings. The notation is complex, featuring many sixteenth and thirty-second notes, and is organized into measures with bar lines. The score is presented in a standard musical notation format, with each staff clearly labeled and the parts arranged vertically.