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**Topic: Music**

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**References:**

[1] Arne Eigenfeldt,  
“*Drum Circle: Intelligent  
Agents in Max/MSP*”,  
ICMC, Copenhagen,  
2007

[2] Arne Eigenfeldt,  
“*Intelligent Rhythm  
Generation in Kinetic  
Engine*”, LNCS Springer,  
Berlin, 2009

[3] Arne Eigenfeldt,  
Multiagency and  
Realtime Composition,  
[http://cec.concordia.ca/  
econtact/index.htm](http://cec.concordia.ca/econtact/index.htm)

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**A Realtime Generative Music System using Autonomous Melody, Harmony, and Rhythm Agents**

**Abstract:**

*Kinetic Engine* is a realtime generative music system that has been in development since 2005. It has been used as an extended instrument within an improvising ensemble, as a networked performance ensemble, as an interactive installation, and as an independent performance system under the composer’s control. Earlier versions were solely concerned with polyphonic rhythmic organization using multi-agents [1]. Version 3 introduced a genetic algorithm for the evolution of a population of rhythms, in realtime, based upon the analysis of music provided [2]. Version 4 explored melodic organization, again using multi-agents [3], while the most recent version adds a third order Markov model for harmonic generation.

This paper will give an overview of the system, examining the interaction of the various agents. Particular emphasis will be given to the recent addition of a harmonic agent, which generates chord sequences based upon analysis of example music. Given one or more MIDI files of harmonic data, *Kinetic Engine* generates a variable order Markov chain of individual harmonic movements. In performance, the user can request certain features (bass movement, harmonic complexity, harmonic tension) from which the system provides the closest match. The harmonic agent thus generates a continual harmonic progression, which guides the melodic agents in their choice of pitches (which, in themselves, are triggered by the rhythmic agents).

Examples of *Kinetic Engine* can be viewed here:

- Version 1 (continuously running installation with infinite variety of generative beats)  
<http://www.sfu.ca/~eigenfel/KineticEngine.mov>
- Version 2 (multi-agents controlling a percussion robot)  
<http://www.sfu.ca/scafiles/sounds/arne/Bhatik.mov>
- Version 3 (generated music performed by humans of rhythms based upon analysis of Cuban rhythms using a genetic algorithm)  
[http://www.sfu.ca/~eigenfel/1\\_Guaguanco.mp4](http://www.sfu.ca/~eigenfel/1_Guaguanco.mp4)
- Version 4 (melodic agents interacting with rhythm agents, controlling a Yamaha Disklavier)  
<http://www.sfu.ca/~eigenfel/InEquilibrio.mp3>

**Keywords:**

Interactive computer music, performance, intelligent systems