

**2007-2008  
AES TORONTO SECTION  
EXECUTIVE**

Chairman	<b>Jeff Bamford</b> Engineering Harmonics (416) 465-3378
Vice Chairman	<b>Sy Potma</b> Fanshawe College, MIA 519-452-4430 x.4973
Recording Secretary/ Past Chair	<b>Robert Breen</b> OIART (519) 686-5010
Treasurer	<b>Paul Reibling</b> (519) 745-1158
Membership	<b>Jim Cox</b> (905) 845-4620
Marketing	<b>Keith Gordon</b> Gennum Corp (905) 632-2996
Bulletin Editor	<b>Earl McCluskie</b> Chestnut Hall Music (519) 894-5308
<b>COMMITTEE MEMBERS</b>	<b>Jim Hayward</b> Hayward Electronics 905-820-0499
<b>Mike Borlace</b> Kinescope Productions (905) 891-0402	<b>Shauna Kennedy</b> (905) 982-0946
<b>Peter Cook</b> CBC Records (416) 205-2317	<b>Roman Klun</b> Innsbruck Records (905) 662-9304
<b>Garrick Filewod</b> Ryerson University (416) 979-5000 x 6872	<b>Dan Mombourquette</b> DM Services (519) 696-8950
	<b>Rob Stevens</b> HGC Engineering (905) 826-4044

Joint AES/SMPTE Presentation  
**Picturing Dither: Dithering Pictures**  
*Stanley Lipshitz, Stanley Fok*

**date  
time  
where**

**Tuesday, 13 November 2007**

**7:00 PM (Note the earlier start time)**

**Eaton Theatre, Ryerson University**

Rogers Communications Building  
80 Gould Street, Toronto, ON  
corner of Gould and Church, east of Yonge St  
(Dundas Subway)

**For parking info and map, goto [www.ryerson.ca/parking/](http://www.ryerson.ca/parking/)  
Pre-Meeting "Dutch Treat" dinner 5:00 pm at the Pickle Barrel  
(corner of Edward and Yonge in the Atrium)**

The desirable properties that follow from the use of (nonsubtractive) triangular probability density function (TPDF) random dither in digital audio quantization and noise shaping are now well known in the audio community. The purposes of this paper are twofold:

(a) To use a visual analogy to aid audio engineers in their understanding of how proper TPDF dithering and noise shaping can convert otherwise objectionable, correlated quantization errors into benign, uncorrelated and less visible ones. As they say, "a picture is worth a thousand words", and (b) To demonstrate, in the process, that the very same concepts, applied now in the spatial instead of the temporal domain, are just as useful and beneficial in the field of digital image processing.

We present color and monochrome images of the results of coarse quantization, both with and without dither and/or noise shaping, to help us make our points. We shall also play audio examples at the same time as we show each picture, so that one can simultaneously both see and hear each effect being discussed.

**Stanley Lipshitz** is professor emeritus in both the departments of Applied Mathematics and Physics at the University of Waterloo in Waterloo, Ontario, Canada. He is one of the founding members of the Audio Research Group at the University of Waterloo, together with his colleague John Vanderkooy, and they conduct research in many areas of audio and electroacoustics. His current research interests include the mathematical theory of dithered quantizers and noise shapers in both audio and image processing, sigma-delta modulators (and their connection with stochastic resonance and chaos), physical acoustics, electroacoustics, transducers, and active noise control. He is a Fellow of the Audio Engineering Society, a recipient of its Silver Medal for his research contributions to digital audio, and of its Publication Award (jointly with John Vanderkooy and Robert Wannamaker) for a paper on quantization and dither. He has served as a Governor of the Audio Engineering Society, and was its President in 1988-9. Other society memberships include the IEEE, the Acoustical Society of America, and the Canadian Acoustical Association. He has presented numerous technical papers, on a wide range of topics, at conferences both in North America and overseas. As Vice-President of the Kitchener-Waterloo Chamber Music Society, he records and broadcasts more than fifty local classical-music concerts annually, and has been doing so digitally for more than twenty-five years.

**Stanley Fok** received the B.A.Sc degree in Computer Engineering from the University of Waterloo, Canada in 2001. He also completed the M.A.Sc. degree in Electrical & Computer Engineering at the same institution in 2002 specializing in image processing. His research interests are in digital signal processing, image and video processing and compression. Currently he is a video algorithm designer at Gennum Corporation.

The Toronto AES Section Bulletin is published ten times yearly by the Audio Engineering Society Toronto Section and is available on the Internet at [www.TorontoAES.org](http://www.TorontoAES.org)

Submissions are welcome. Articles may be reprinted with the author's permission. Space is available for AES related companies and individuals wishing to address our members. For submissions, advertising rates or other info, email [TorontoAES@TorontoAES.org](mailto:TorontoAES@TorontoAES.org).

**AES Toronto appreciates the  
continuing support of  
RYERSON UNIVERSITY**

This month's meeting  
sponsored by...

**GENNUM**  
CORPORATION

**PLEASE POST - MEMBERS AND GUESTS WELCOME**