

Workshop Discussion Topic

Non-Linear Output from Image Sensors: Applications, Techniques, and Limitations

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Abstract

The discussion topic of non-linear output is relevant for all image sensor technologies including CCDs, CMOS passive pixel sensors, and CMOS active pixel sensors. Typically, image sensor technologists strive for linearity in their sensors. However, for many applications, linearity is not necessary and non-linear output can bring certain advantages, such as an increase in scene-referred dynamic range. Non-linearity can also bring unwelcome complications in color signal processing, compression and radiometric measurements.

The discussion will begin with a discussion of applications and techniques of non-linear output, including classic gamma correction for displays, square rooting ($\Gamma=2$) for noise, and logarithmic output. Dynamic range enhancement using "Hyper-D" CCDs, "dynasensor" CCDs, "WIDyR CMOS APS, and other inputs will be reviewed. Logarithmic CMOS imager work at Caltech, IMEC and IMS will be reviewed.

One interesting topic of discussion is should non-linearization be performed in the pixel, or after readout? Advantages (increased dynamic range, reduced susceptibility to blooming, fewer ADC bits, etc.) and limitations (uniformity, frequency response, pixel complexity, contrast reduction, etc.) of both will be addressed.