Appendix B – Example of Implementation of the Flicker Perception Metric Calculation as a Matlab® Function

This appendix is published in the following document:

Alliance for Solid-State Illumination Systems and Technologies (ASSIST). 2015. *ASSIST recommends… Recommended metric for assessing the direct perception of light source flicker.* Vol. 11, Iss. 3. Troy, N.Y.: Lighting Research Center. Internet: http://www.lrc.rpi.edu/programs/solidstate/assist/recommends/flicker.asp.

```
function [Mp,f,Mpk,M] = LRCFlickerMetric(waveform,Srate)
% Function for calculating LRC Flicker Perception Metric
%
% Input arguments:
%   waveform:   column vector containing waveform values
%   Srate:      sample rate of waveform in Samples/s (Hz)
%
% Output variables:
%   Mp:     Perceived Modulation (the LRC Flicker Metric)
%   f:      Vector of frequency values in Hz
%   Mpk:    Spectral perceived modulation vector (1 = detection threshold)
%   M:      Spectral modulation vector (values in percent modulation)

% Originally created by Dashiell Bodington on 25-Sep-2013
% Last updated and modified by Andrew Bierman on 13-Jan-2015

if ~(rem(length(waveform),2) == 0) % if the length is not even
    waveform = waveform(1:end-1);  % make length an even number
end

% Modulation detection threshold spectrum
SF = [5 10 15 20 25 40 60]; % Frequencies, Hz
ST = [0.846 0.568 0.542 0.759 1.198 5.677 56.157]/100; % Threshold values
%Interpolate sensitivity with 5th degree polynomial
P = polyfit(SF, ST, 5);
% 5th order polynomial nearly the same fit and not badly conditioned as is
% 6th degree

% Fourier Transform
X = abs(fft(waveform)); % abs computes component amplitudes of complex fft

% One-sided transform values expressed as a ratio of the dc value (Weber
% temporal contrast)
M = 2*X(1:length(X)/2+1)/X(1);

%Calculate Frequency Axis
f = (Srate/2)*linspace(0,1,length(M))';

% Human sensitivity weighting, Modulation detection threshold (Mdth)
Mdth = NaN*ones(size(f)); % Initialize array to not-a-number values
for i=1:length(f)
    if(f(i) <= 65 && f(i) >= 5) % 65 is where extrapolated modulation=100%
        Mdth(i) = (P(1)*f(i)^5) + (P(2)*f(i)^4) + (P(3)*f(i)^3) + ...
                  (P(4)*f(i)^2) + (P(5)*f(i)) + P(6);
    end
end

% Apply human sensitivity weighting (i.e., divide by modulation detection
% threshold)
Mpk = M./Mdth;
Mpk(isnan(Mdth)) = 0; % Replace not-a-number values with zero

% Summation resulting in single-number metric
Mp = sqrt(sum(Mpk.^2));
end
% End of program ------------------------------------------------------------------
```