# What Is The "Crest Factor" And Why Is It Used?
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Introduction

The Crest Factor is equal to the peak amplitude of a waveform divided by the RMS value. The purpose of the crest factor calculation is to give an analyst a quick idea of how much impacting is occurring in a waveform. Impacting is often associated with roller bearing wear, cavitation and gear tooth wear.
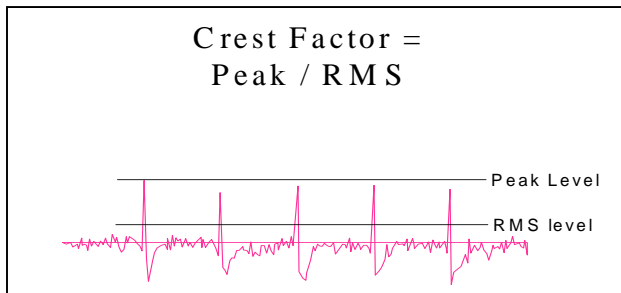

(Figure 1: Definition of Crest Factor)

In a perfect sine wave, with an amplitude of "1", the RMS value is equal to .707, and the crest factor is then equal to 1.41. A perfect sine wave contains no impacting and therefore crest factors with a value higher than 1.41 imply that there is some degree of impacting.

The Problem with the Fast Fourier Transform (FFT)

The definition of the Fast Fourier Transform implies that any signal can be approximated by the sum of a set of sine waves. Unfortunately, this doesn't work so well when one has a signal that consists of non-periodic events, impacts or random noise (See figures 2 and 3). Both impacts and random noise appear the same in the spectrum although they mean different things in the context of machinery vibration analysis. The crest factor is therefore useful in giving the analyst a quick idea of what is occurring in the time waveform.
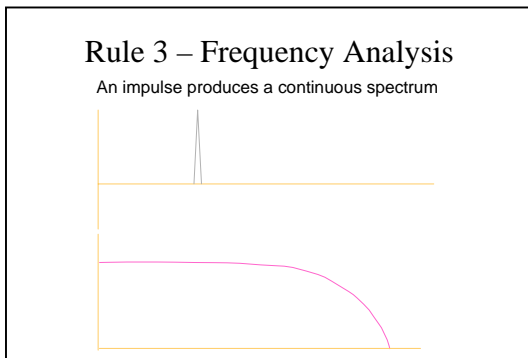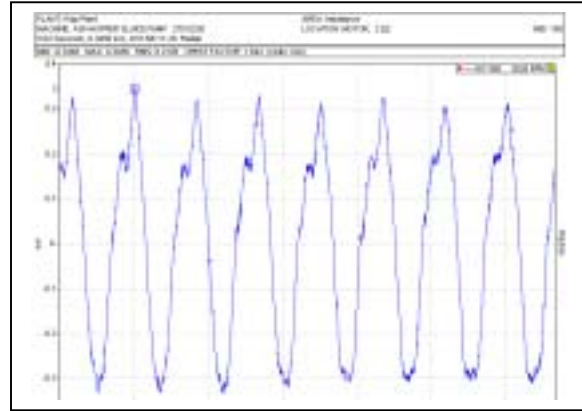

(Figure 2)
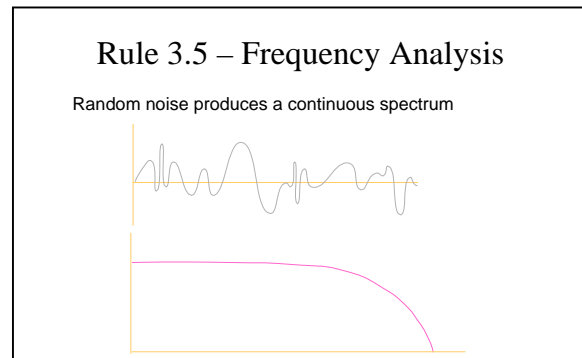
(Figure 3)
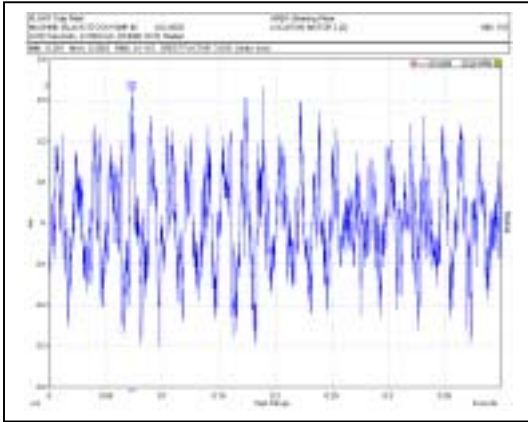
(Figure 4)

(Figure 5)

Comparison of 2 Waveforms

In figures 4 and 5 we can see an example of the use of the Crest Factor. The waveform in figure 4 has a crest factor of 3.01. The waveform in figure 5 has a crest factor of 1.61. The data in figure 4 represents a machine with serious rolling element bearing wear, and the crest factor is relatively high due to the amount of impacting occurring within the bearing. The data in figure 5 represents a machine with an unbalance, but no impacting related to bearing wear.

Conclusion

The Crest Factor is a quick and useful calculation that gives the analyst an idea of how much impacting is occurring in a time waveform. This is useful information that is lost if one is only viewing a spectrum as the FFT cannot differentiate between impacting and random noise. Impacting in a time waveform may indicate rolling element bearing wear, gear tooth wear or cavitation. Quite often, the Crest Factor is trended over time in order to see if the amount of impacting is increasing or not.