



Standard Practices for Cycle Counting in Fatigue Analysis¹

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1. Scope

1.1 These practices are a compilation of acceptable procedures for cycle-counting methods employed in fatigue analysis. This standard does not intend to recommend a particular method.

1.2 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 ASTM Standards:

E 912 Definitions of Terms Relating to Fatigue Loading²

3. Terminology

3.1 Definitions:

3.1.1 *constant amplitude loading—in fatigue loading*, a loading in which all of the peak loads are equal and all of the valley loads are equal.

3.1.2 *cycle—in fatigue loading*, under constant amplitude loading, the load variation from the minimum to the maximum and then to the minimum load.

NOTE 1—In spectrum loading, definition of cycle varies with the counting method used.

3.1.3 *mean crossings—in fatigue loading*, the number of times that the load-time history crosses the mean-load level with a positive slope (or a negative slope, or both, as specified) during a given length of the history (see Fig. 1).

3.1.3.1 *Discussion*—For purposes related to cycle counting, a mean crossing may be defined as a crossing of the reference load level.

3.1.4 *mean load, P_m —in fatigue loading*, the algebraic average of the maximum and minimum loads in constant amplitude loading, or of individual cycles in spectrum loading,

$$P_m = (P_{\max} + P_{\min})/2 \quad (1)$$

or the integral average of the instantaneous load values or the

algebraic average of the peak and valley loads of a spectrum loading history.

3.1.5 *peak—in fatigue loading*, the point at which the first derivative of the load-time history changes from a positive to a negative sign; the point of maximum load in constant amplitude loading (see Fig. 1).

3.1.6 *range—in fatigue loading*, the algebraic difference between successive valley and peak loads (positive range or increasing load range), or between successive peak and valley loads (negative range or decreasing load range); see Fig. 1.

NOTE 2—In spectrum loading, range may have a different definition, depending on the counting method used; for example, “overall range” is defined by the algebraic difference between the largest peak and the smallest valley of a given load-time history.

3.1.6.1 *Discussion*—In cycle counting by various methods, it is common to employ ranges between valley and peak loads, or between peak and valley loads, which are not necessarily successive events. In these practices, the definition of the word “range” is broadened so that events of this type are also included.

3.1.7 *reversal—in fatigue loading*, the point at which the first derivative of the load-time history changes sign (see Fig. 1).

NOTE 3—In constant amplitude loading, a cycle is equal to two reversals.

3.1.8 *spectrum loading—in fatigue loading*, a loading in which all of the peak loads are not equal or all of the valley loads are not equal, or both. (Also known as variable amplitude loading or irregular loading.)

3.1.9 *valley—in fatigue loading*, the point at which the first derivative of the load-time history changes from a negative to a positive sign (also known as trough); the point of minimum load in constant amplitude loading (see Fig. 1).

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *load*—used in these practices to denote force, stress, strain, torque, acceleration, deflection, or other parameters of interest.

3.2.2 *reference load—for spectrum loading*, used in these practices to denote the loading level that represents a steady-state condition upon which load variations are superimposed. The reference load may be identical to the mean load of the history, but this is not required.

3.3 For other definitions of terms used in these practices

¹ These practices are under the jurisdiction of ASTM Committee E-8 on Fatigue and Fracture and are the direct responsibility of Subcommittee E08.04 on Structural Applications.

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² Discontinued, see 1986 Annual Book of ASTM Standards, Vol 03.01.