ANSI/ASA S2.1-2009 / ISO 2041:2009
(Revision of ANSI S2.1-2000 / ISO 2041:1990)

Reaffirmed by ANSI
September 11, 2014

AMERICAN NATIONAL STANDARD

Mechanical vibration, shock and condition monitoring – Vocabulary

(a Nationally Adopted International Standard)

ANSI/ASA S2.1-2009/ISO 2041 :2009

Accredited Standards Committee S2, Mechanical Vibration and Shock

Standards Secretariat
Acoustical Society of America
35 Pinelawn Road, Suite 114 E
Melville, NY 11747-3177

The American National Standards Institute, Inc. (ANSI) is the national coordinator of voluntary standards development and the clearinghouse in the U.S.A. for information on national and international standards.

The Acoustical Society of America (ASA) is an organization of scientists and engineers formed in 1929 to increase and diffuse the knowledge of acoustics and to promote its practical applications.

ANSI/ASA S2.1-2009 / ISO 2041:2009
(Revision of ANSI S2.1-2000 / ISO 2041:1990)

AMERICAN NATIONAL STANDARD

Mechanical vibration, shock and condition monitoring – Vocabulary

(a Nationally Adopted International Standard)

Secretariat:

Acoustical Society of America

Approved October 8, 2009 by:

American National Standards Institute, Inc.

Abstract

This Nationally Adopted International Standard defines terms and expressions unique to the areas of mechanical vibration, shock and condition monitoring.

AMERICAN NATIONAL STANDARDS ON ACOUSTICS

The Acoustical Society of America (ASA) provides the Secretariat for Accredited Standards Committees S1 on Acoustics, S2 on Mechanical Vibration and Shock, S3 on Bioacoustics, S3/SC 1 on Animal Bioacoustics, and S12 on Noise. These committees have wide representation from the technical community (manufacturers, consumers, trade associations, organizations with a general interest, and government representatives). The standards are published by the Acoustical Society of America through the American Institute of Physics as American National Standards after approval by their respective Standards Committees and the American National Standards Institute (ANSI).

These standards are developed and published as a public service to provide standards useful to the public, industry, and consumers, and to Federal, State, and local governments.

Each of the accredited Standards Committees (operating in accordance with procedures approved by ANSI) is responsible for developing, voting upon, and maintaining or revising its own Standards. The ASA Standards Secretariat administers Committee organization and activity and provides liaison between the Accredited Standards Committees and ANSI. After the Standards have been produced and adopted by the Accredited Standards Committees, and approved as American National Standards by ANSI, the ASA Standards Secretariat arranges for their publication and distribution.

An American National Standard implies a consensus of those substantially concerned with its scope and provisions. Consensus is established when, in the judgment of the ANSI Board of Standards Review, substantial agreement has been reached by directly and materially affected interests. Substantial agreement means much more than a simple majority, but not necessarily unanimity. Consensus requires that all views and objections be considered and that a concerted effort be made towards their resolution.

The use of an American National Standard is completely voluntary. Their existence does not in any respect preclude anyone, whether he or she has approved the Standards or not, from manufacturing, marketing, purchasing, or using products, processes, or procedures not conforming to the Standards.

NOTICE: This American National Standard may be revised or withdrawn at any time. The procedures of the American National Standards Institute require that action be taken periodically to reaffirm, revise, or withdraw this Standard.

Acoustical Society of America
ASA Secretariat
35 Pinelawn Road, Suite 114E
Melville, New York 11747-3177
Telephone: 1 (631) 390-0215
Fax: 1 (631) 390-0217
E-mail: asastds@aip.org

Contents

Tables

Figures

Foreword

[*This Foreword is for information only and is not a part of ANSI/ASA S2.1-2009 / ISO 2041:2009 American National Standard Mechanical vibration, shock and condition monitoring – Vocabulary*.]

This nationally adopted international standard comprises a part of a group of definitions, standards, and specifications for use in mechanical vibration and shock. It was developed and approved by Accredited Standards Committee S2 Mechanical Vibration and Shock, under its approved operating procedures. Those procedures have been accredited by the American National Standards Institute (ANSI). The Scope of Accredited Standards Committee S2 is as follows:

> *Standards, specification, methods of measurement and test, and terminology in the field of mechanical vibration and shock, and condition monitoring and diagnostics of machines, including the effects of exposure to mechanical vibration and shock on humans, including those aspects which pertain to biological safety, tolerance and comfort.*

This standard is an identical national adoption of ISO 2041:2009 which was prepared by Technical Committee ISO/TC 108, *Mechanical vibration, shock and condition monitoring*. This standard is a revision of ANSI S2.1-2000/ISO 2041:1990. This revision reflects advances in technology and refinements in terms used in the previous version. As such, it incorporates more precise definitions of some terms reflecting changes in accepted meaning. New terms which were driven by changes in technology (primarily in the areas of signal processing, condition monitoring and vibration and shock diagnostics and prognostics) are incorporated.

At the time this Standard was submitted to Accredited Standards Committee S2, Mechanical Vibration and Shock for approval, the membership was as follows:

A.T. Herfat, *Chair*
C.F. Gaumond, *Vice-Chair*

S.B. Blaeser, *Secretary*

Acoustical Society of America.....C.F. Gaumond
.....B.E. Douglas (Alt.)

American Industrial Hygiene Association ..... J.J. Earshen
..... D. Driscoll (Alt.)

Association of American Railroads.....J. Moller
..... N. Cooperrider (Alt.)

Boeing..... K.D. Sellers
.....D.A. Followell (Alt.)

BP America.....W.C. Foiles
.....J. McCraw (Alt.)

Calnetix..... L.A. Hawkins
.....P. McMullen (Alt.)

Caterpillar, Inc......D.G. Roley

Commercial Vehicle Group ..... L. Mullinix

Eckardt Johanning, MD, PC ..... E. Johanning

Emerson Electric – Copeland Corporation ..... A.T. Herfat
..... M. Mezache (Alt.)

Endevco Corp. ..... B. Yang

G.E. Energy ..... R. Bankert

Infrared Training Center ..... G.L. Orlove
..... R. Madding (Alt.)

John Deere ..... L. DeVries

Mechanical Solutions, Inc. ..... W.D. Marscher
..... M. Onari (Alt.)

MIMOSA ..... K. Bever
..... A. Johnston (Alt.)

NASA Ames Research Center ..... K.F. Goebel

National Institute for Occupational Safety and Health (NIOSH) ..... R. Dong
..... T.W. McDowell (Alt.)

National Institute of Standards & Technology ..... D.J. Evans
..... S. Fick (Alt.)

PCB Group ..... R.D. Sill
..... D. Lally (Alt.)

Power Tool Institute, Inc. ..... W.D. Spencer
..... M. Hickok (Alt.)

Quest Technologies, Inc. ..... M. Wurm
..... P. Battenberg (Alt.)

Schenck Trebel Corp. ..... B. Dittmar

Shock and Vibration Information and Analysis Center (SAVIAC) ..... V.I. Bateman
..... J.E. Howell (Alt.)

Siemens Power Generation, Inc. ..... M. L'vov
..... L. Zeller (Alt.)

U.S. Air Force ..... S.D. Smith

U.S. Army Center for Health Promotion and Preventive Medicine ..... S. Chervak
..... M. Callison (Alt.)

U.S. Department of Transportation – Volpe ..... J.K. Pollard
..... T. Raslear (Alt.)

U.S. Naval Sea Systems Command ..... R. Taddeo
..... M.T. McGown (Alt.)

U.S. Naval Surface Warfare Center – Carderock ..... P. Shang
..... S.P. Antonides (Alt.)

U.S. Naval Surface Warfare Center – Panama City ..... B.L. Price

UE Systems, Inc. ..... M. Goodman

Vibration Institute.....R.L. Eshleman
.....D.J. Vendittis (Alt.)

Waukesha Magnetic Bearings.....K. Bornstein
..... R. Shultz (Alt.)

Individual Experts of Accredited Standards Committee S2, Mechanical Vibration and Shock, were:

A.J. Brammer
D.D. Reynolds
D.E. Wasserman

Working Group S2/WG 2, Terminology and Nomenclature in the Field of Mechanical Vibration and Shock and Condition Monitoring and Diagnostics of Machines, which assisted Accredited Standards Committee S2, Mechanical Vibration and Shock, in the development of this standard, had the following membership.

D.J. Evans, Chair

M. Craun
B.E. Douglas
C.F. Gaumond
R.J. Peppin

Suggestions for improvements of this standard will be welcomed. They should be sent to Accredited Standards Committee S2, Mechanical Vibration and Shock, in care of the Standards Secretariat of the Acoustical Society of America, 35 Pinelawn Road, Suite 114E, Melville, New York 11747-3177. Telephone: 631-390-0215; FAX: 631-390-0217; E-mail: asastds@aip.org.

Introduction

Vocabulary is the most basic of subjects for standardization. Without an accepted standard for the definition of terminology, the development of other technical standards in a technical area becomes a laborious and time-consuming task that would ultimately result in the inefficient use of time and a high probability of misinterpretation.

American National Standard Mechanical vibration, shock and condition monitoring – Vocabulary

Scope

This Nationally Adopted International Standard defines terms and expressions unique to the areas of mechanical vibration, shock and condition monitoring.

1 General

1.1
displacement
relative displacement
⟨vibration and shock⟩ time varying quantity that specifies the change in position of a point on a body with respect to a reference frame

NOTE 1 The reference frame is usually a set of axes at a mean position or a position of rest. In general, a rotation displacement vector, a translation displacement vector, or both can represent the displacement.

NOTE 2 A displacement is designated as relative displacement if it is measured with respect to a reference frame other than the primary reference frame designated in a given case.

NOTE 3 Displacement can be:

— oscillatory, in which case simple harmonic components can be defined by the displacement amplitude (and frequency), or

— random, in which case the root-mean-square (rms) displacement (and band-width and probability density distribution) can be used to define the probability that the displacement will have values within any given range.

Displacements of short time duration are defined as transient displacements. Non-oscillatory displacements are defined as sustained displacements, if of long duration, or as displacement pulses, if of short duration.

1.2
velocity
relative velocity
⟨vibration and shock⟩ rate of change of displacement

NOTE 1 In general, velocity is time-dependent.

NOTE 2 The reference frame is usually a set of axes at a mean position or a position of rest. In general, a rotation velocity vector, a translation velocity vector, or both can represent the velocity.

NOTE 3 A velocity is designated as relative velocity if it is measured with respect to a reference frame other than the primary reference frame designated in a given case. The relative velocity between two points is the vector difference between the velocities of the two points.

NOTE 4 Velocity can be:

— oscillatory, in which case simple harmonic components can be defined by the velocity amplitude (and frequency), or

— random, in which case the root-mean-square (rms) velocity (and band-width and probability density distribution) can be used to define the probability that the velocity will have values within any given range.