



Standard Test Method for Integration of Digital Spectral Data for Weathering and Durability Applications¹

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1. Scope

1.1 This test method specifies a single relatively simple method to implement, common integration technique, the Modified Trapezoid Rule, to integrate digital or tabulated spectral data. The intent is to produce greater consistency and comparability of weathering and durability test results between various exposure regimes, calculation of materials properties, and laboratories with respect to numerical results that depend upon the integration of spectral distribution data.

1.2 Weathering and durability testing often requires the computation of the effects of radiant exposure of materials to various optical radiation sources, including lamps with varying spectral power distributions and outdoor and simulated sunlight. Changes in the spectrally dependent optical properties of materials, in combination with exposure source spectral data, are often used to evaluate the effect of exposure to radiant sources, develop activation spectra (Practice G178), and classify, evaluate, or rate sources with respect to reference or exposure source spectral distributions. Another important application is the integration of the original spectrally dependent optical properties of materials in combination with exposure source spectral data to determine the total energy absorbed by a material from various exposure sources.

1.3 The data applications described in 1.2 often require the use of tabulated reference spectral distributions, digital spectral data produced by modern instrumentation, and the integrated version of that data, or combinations (primarily multiplication) of spectrally dependent data.

1.4 Computation of the material responses to exposure to radiant sources mentioned above require the integration of measured wavelength dependent digital data, sometimes in conjunction with tabulated wavelength dependent reference or comparison data.

1.5 The term “integration” in the previous sections refers to the numerical approximation to the true integral of continuous

functions, represented by discrete, digital data. There are numerous mathematical techniques for performing numerical integration. Each method provides different levels of complexity, accuracy, ease of implementation and computational efficiency, and, of course, resultant magnitudes. Hulstrom, Bird and Riordan (1)² demonstrate the differences between results for rectangular (963.56 W/m²), trapezoid rule (962.53 W/m²), and modified trapezoid rule (963.75 W/m²) integration for a single solar spectrum. Thus the need for a standard integration technique to simplify the comparison of results from different laboratories, measurement instrumentation, or exposure regimes.

1.6 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

1.7 *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:³

- E275 Practice for Describing and Measuring Performance of Ultraviolet and Visible Spectrophotometers
- E424 Test Methods for Solar Energy Transmittance and Reflectance (Terrestrial) of Sheet Materials
- E490 Standard Solar Constant and Zero Air Mass Solar Spectral Irradiance Tables
- E772 Terminology of Solar Energy Conversion
- E903 Test Method for Solar Absorptance, Reflectance, and Transmittance of Materials Using Integrating Spheres
- E927 Specification for Solar Simulation for Photovoltaic Testing
- E971 Practice for Calculation of Photometric Transmittance and Reflectance of Materials to Solar Radiation

¹ This test method is under the jurisdiction of ASTM Committee G03 on Weathering and Durability and is the direct responsibility of Subcommittee G03.09 on Radiometry.

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² The boldface numbers in parentheses refer to a list of references at the end of this standard.

³ For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.