

Bibliography

Berger-Schunn, A., *Practical Color Measurement: A Primer for the Beginner, A Reminder for the Expert*. New York: Wiley (1994).

Berns, R. S., F. W. Billmeyer, and M. Saltzman, *Bill-meyer and Saltzman's Principles of Color Technology*. New York: Wiley (2000).

Derhak, M. W. and R. S. Berns, Introducing Wpt (Way-point): A color equivalency representation for defining a material adjustment transform. *Color Research and Application*, **40**: 535–549, (2015).

Diaries of Albert H. Munsell. Retrieved June 11, 2018, from http://www.rit.edu/cos/colorscience/ab_munsell_diaries.php

Grum, F. and C. J. Bartleson, *Optical Radiation Measurements. Volume 2: Color Measurement*, New York: Academic Press, (1980).

Hunt, R. W. and M. Pointer, *Measuring Colour*. Chichester, West Sussex, U.K.: Wiley (2011).

INTERNATIONAL COLOR CONSORTIUM. Retrieved March 15, 2018, from <http://www.color.org/>

Judd, D. B. and G. Wyszecki, *Color in Business, Science and Industry*. New York: John Wiley (1975).

Kang, H. R., *Color Technology for Electronic Imaging Devices*. SPIE Optical Engineering Press (1997).

Kang, H. R., *Computational Color Technology* (SPIE Press Monograph Vol. Pm159). SPIE-International Society for Optical Engineering (2006).

Klein, G. A., *Industrial Color Physics*. New York, NY: Springer (2010).

MacAdam, D. L., *Color Measurement: Theme and Variations*. Berlin: Springer (1985).

MacAdam, D. L., Visual Sensitivities to Color Differences in Daylight, *J. Opt. Soc. Am.* **32**, 247–274 (1942).

Bibliography

Natural Color System. Retrieved June 11, 2018, <http://ncscolour.com>

Sharma, G., *Digital Color Imaging Handbook*. CRC Press, Inc., Boca Raton, FL, USA (2002).

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