

J H XIN, The Hong Kong Polytechnic University, Hong Kong

This book is intended to provide a basic yet comprehensive understanding of many aspects of colour management with industrial applications in mind. It is suitable for individuals from a variety of disciplines and organisation levels in colour management, colour quality monitoring and evaluation, textiles, fashion, design, graphic printing, desktop publishing, dyestuff, paint, ink, plastics, cosmetics, food and beverages, etc. The list includes colourists, colour quality assessors, colour co-ordinators, graphic designers, merchandisers, product development specialists, academics or anyone who uses colour in their work. It is also suitable for university students in textiles, fashion, design, fine arts, or any other colour-related courses.

This book has two parts: Part I – Measuring colour and Part II – Managing colour. There are a total of 11 chapters, Chapters 1–5 in Part I and Chapters 6–11 in Part II. Chapters are written by experts in their relevant fields covering subjects from colour science, colour quality evaluation, colour simulation, colour communication and colourant formulation, to colour management in the supply chain and colour assurance systems. A number of figures are reproduced additionally in colour in a four-page colour section.

Chapter 1 covers colour perception, which explains the nature of colour, the physical basis of colour, the human colour vision system and colour perception, as ‘colour exists only in the mind; it is a perceptual response to light that enters the eye either directly from self-luminous light sources or, indirectly, from light reflected by illuminated objects’.

Chapter 2 describes colour specification systems which include the CIE system of colour specification, colour order systems and colour specifiers. ‘The colour of an object depends on many factors, such as lighting, size of sample, and background and surrounding colours. Much more importantly, colour is a subjective phenomenon and depends on the observer. The measurement of subjective phenomena, such as colour, taste and smell, is obviously more difficult than that of objective phenomena such as mass, length and time.’ ‘When assessing the usefulness of the colour specification system,

the reader should carefully consider how far the system enables us to deal with real problems with respect to colour and how far the system fails to deal with the subjective nature of colour.'

Chapter 3 focuses on instrumental colour measurement. 'Colour measurements are essentially measurements of light shining through an object or light reflected from an object.' The measurements in terms of diffuse and regular reflectance and transmittance are explained and so are the optical configurations and standard or recommended geometries for making these measurements.

Chapter 4 explains colour quality evaluation. It is well understood in the colour-related industries that 'the most important use of the measurement data is undoubtedly for colour quality control in terms of colour difference ( $\Delta E$ ) between a pair of samples.' In this chapter, the colour difference formulae CIELAB, CMC (1:c), CIE94( $K_L:K_C:K_H$ ), and the most recent CIEDE2000 ( $K_L:K_C:K_H$ ) are discussed in detail. These are followed by the set-up of industrial colour tolerance, observer uncertainty, the phenomenon of metamerism, colour constancy, as well as the calculation of the colour inconstancy index.

Chapter 5 is a practical guide to visual evaluation of textile samples. Visual colour evaluation is 'the most straightforward method of assessing the quality of one colour versus another.' Visual colour evaluation must be standardised as much as possible so as to minimise the subjectivity that exists in individuals. This chapter discusses various aspects of the visual colour evaluation process including the illuminant, the object, and the observer. Industrial guidelines for visual colour assessment including AATCC and ASTM D1729 methods are listed and explained. In the latter part of the chapter, the practical application of visual colour assessment methods is discussed in detail.

Chapter 6 'Colour simulation of textiles' is the first chapter of Part II: 'Managing colour'. This chapter discusses the accurate colour simulation on display devices including solid colour and colour samples with texture structures, such as textile fabrics. The colour synthesis technique for three-dimensional textile products, which is based on a physical vision model, is also presented. Colour mapping algorithms for two- and three-dimensional textile fabric and textile products are introduced. The texture effect on visual colour difference evaluation is also investigated.

Chapter 7 discusses effective ways of colour communication. The importance of colour within today's retail environment is examined, and historic and current practices for colour communication between the specifier and the supply chain are critically reviewed. This is followed by an analysis of current 'best practice' in the chain together with associated impacts and benefits. It concludes with a proposed forecast of how colour could be managed in the future.

Chapter 8 is on controlling colourant formulation. ‘Computer colourant formulation has been widely applied, especially when supplying coloured articles to companies with global sourcing practice thanks to the formidable advance of computers, especially personal computers. This greatly improves the lead-time for colour matching, especially when experienced colourists are not available. It has become a necessity for a modern dyehouse to install a computer colourant formulation system.’ This chapter explains the widely adopted Kubelka–Munk theory and the practices for computer colourant formulation of textile materials. It also discusses recipe correction methods, ways of improving formulation accuracy, and the use of artificial neural networks in colourant formulation.

Chapter 9 discusses digital colour printing on textiles. ‘If the same print design were digitally printed on a variety of different printers using the same type of ink sets and fabric, the color results would vary widely.’ ‘Factors such as environmental conditions, ink properties and print head construction can cause results to vary from day to day using exactly the same printer and inks. This can be very troublesome and frustrating for print providers.’ Therefore, this chapter focuses on the multifaceted factors that users of digital textile printing technology must address in order to control the application of colour to digitally printed fabrics.

Chapter 10 concentrates on colour management across the supply chain. It explains the structure of a typical colour critical supply chain in the apparel industry. ‘This industry is chosen as an example because colour is so important there and garment supply chains are unusually complex, but the general points apply to plastic components, supply chains for the automotive or electronic industries, for example, and to many other supply chains.’ Requirements of the supply chain colour process, methods of colour communication throughout the supply chain versus those requirements, the role of the application service provider (ASP) model, best practice for supply chain colour management, and future trends are discussed in detail.

Chapter 11 is on quality assurance management for coloured goods. It discusses quality assurance issues in the reproduction of colour, which includes traditional identification of colour attributes and recipe/reproduction forecasting, the use of instrumental or computer recipe prediction, colour variation evaluation and monitoring, and colour performance which includes fitness for purpose and testing methodology.

The editor hopes that this book, through the comprehensive discussion of some essential elements, will provide useful guidance for total colour management in most colour-related industries.



# Part I

Measuring colour

---

