

**What is Output Linearization?** (For the elementary hues, see CIE R1-47:2009.)  
 The colour space of a double cone includes 6 colours. The six colours can be the device-dependent device colours (index d): ( $R, Y, G, B, N, W_d$ ) or the device-independent elementary colours (index e): ( $R, Y, G, B, N, W_e$ ). Elementary red appears neither yellowish nor bluish. The hue angle is  $h_{ab,e} = 26$ .

For example for the sRGB colours according to IEC 61966-2-1 it is valid:  
 Device red  $R_d$  has the coordinates  $rgb^*_{d,Rd} = (L^*, C^*_{ab}, h_{ab})Rd$   
 Elementary red  $R_e$  has the coordinates  $rgb^*_{e,R} = (L^*, C^*_{ab}, h_{ab})Re$   
 Corresponding data are given in the following for  $R_d, Re$ , and  $W=W_d=W_e$

$$rgbW = (1 \ 1 \ 1)W$$

$$LCh^*W = (L^*, C^*_{ab}, h_{ab})W = (95, 0, -)W$$

$$rgb^*_{d,Rd} = (1 \ 0 \ 0)Rd$$

$$LCh^*_{d,Rd} = (50, 100, 40)Rd$$

$$rgbRe = (1 \ 0 \ 0)Re$$

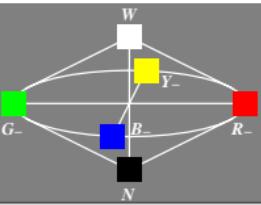
$$LCh^*_{e,R} = (50, 87, 26)Re$$

**Output Linearization of CIE R1-09:2015** produces for the hue angle  $h_{ab,Re} = 26$  the CIELAB data  $L^*_{Re} = 50$  and  $C^*_{ab,Re} = 87$ . These CIELAB data are produced with the device to elementary input data (de)

$$rgb_{de,Re} = (1 \ 0 \ 0,26)de,Re$$

A calculated table for 360 hue angles includes:

$h_{ab}$	$LCh^*_{de}$	$rgb_{de}$
26	50 87 26	1 0 0,26

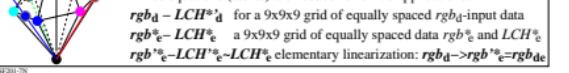


**Three device (d) coordinates  $rgb^*_d$  describe 8 device colours  $RGB_d, CMY_d$ , and  $NW$ .**  
 Hexagon-triangle system based on device (d) colours:  $rgb^*_{d,a}$  with linear relations between  $rgb^*_{d,a} - LCh^*_{d,a}$  (compare approximately linear relations between  $rgb^*_{sRGB}$  and  $L^*$ )

Equations  $rgb^*_{d,a} - LCh^*_{d,a}$  in both directions have been published, see: Richter, CIE-Proceedings, Beijing, 2008, Volume 3 and DIN 33872-1  
 Three equations (tables) are needed for office applications:  
 $rgb_d - LCh^*_{d,a}$  for a 9x9x9 grid of equally spaced  $rgb_d$  input data  
 $rgb^*_{d,a} - LCh^*_{d,a}$  a 9x9x9 grid of equally spaced data  $rgb^*_{d,a}$  and  $LCh^*_{d,a}$   
 $rgb^*_{d,a} - LCh^*_{d,a} - LCh^*_{d,a}$  device linearization:  $rgb_d \rightarrow rgb^*_{d,a} = rgb_{dd}$

**Three elementary (e) coordinates  $rgb^*_e$  describe 8 colours  $RGB_e, CMY_e$ , and  $NW$ .**  
 Hexagon-triangle system based on elementary (e) colours:  $rgb^*_{e,a}$  with linear relations between  $rgb^*_{e,a} - LCh^*_{e,a}$  (compare approximately linear relations between  $rgb^*_{sRGB}$  and  $L^*$ )

Equations  $rgb^*_{e,a} - LCh^*_{e,a}$  in both directions have been published, see: Richter, CIE-Proceedings, Beijing, 2008, Volume 3 and DIN 33872-1  
 Three equations (tables) are needed for office applications:  
 $rgb_d - LCh^*_{d,a}$  for a 9x9x9 grid of equally spaced  $rgb_d$ -input data  
 $rgb^*_{e,a} - LCh^*_{e,a}$  a 9x9x9 grid of equally spaced data  $rgb^*_{e,a}$  and  $LCh^*_{e,a}$   
 $rgb^*_{e,a} - LCh^*_{e,a} - LCh^*_{e,a}$  elementary linearization:  $rgb_d \rightarrow rgb^*_{e,a} = rgb_{de}$



entrée:  $w/rgb/cmyk \rightarrow w/rgb/cmykd$   
 sortie: aucun changement

Input	Output	Input and output media and applications	Standard
Input media	Output media	Application	
-	-	-	DIN 33866-1
analog	analog	DIN-test chart (hardcopy)	Hardcopy Copier DIN 33866-2
analog	digital	DIN-test chart (hardcopy)	File Scanner DIN 33866-4
digital	analog	DIN-test chart (File)	Hardcopy Printer DIN 33866-3
			Softcopy Display DIN 33866-5

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Input	Output	Input and output media and applications	Standard or TR
Input media	Output media	Application	Technical Report
-	-	-	ISO/IEC TR 24705
analog	analog	ISO/IEC-test chart (hardcopy)	Hardcopy Copier ISO/IEC 15775
analog	digital	ISO/IEC-test chart (hardcopy)	File Scanner ISO/IEC TR 24705
digital	analog	ISO/IEC-test chart (File)	Hardcopy Printer ISO/IEC TR 24705
			Softcopy Display ISO/IEC TR 24705

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Input	Output	Input and output media and applications	Technical Report (TR) or Standard	Method & Test: Linearization
Input media	Output media	Application		
-	-	-	DIN 33866-1	DIN 33866-1
analog	analog	ISO/IEC-file series equally spaced in $rgb$ + ISO/IEC-test chart (hardcopy) series equally spaced in $LCh^*$	Hardcopy Copier ISO/IEC 15775	DIN 33866-2
analog	digital	ISO/IEC-test chart (hardcopy) series equally spaced in $LCh^*$	File Scanner ISO/IEC TR 24705	DIN 33866-4
digital	analog	ISO/IEC-test chart (File) series equally spaced in $rgb$	Hardcopy Printer ISO/IEC TR 24705	DIN 33866-3
			Softcopy Display ISO/IEC TR 24705 ISO 9241-306:2008	DIN 33872-2, 4
				DIN 33866-5
				DIN 33872-2, 4

The ISO/IEC-input linearisation method produces an ISO/IEC-file from an ISO/IEC-original scene:  
 Flower motif with 16 equidistant grey steps, and 14 CIE-test colours according to CIE 13.3

The ISO/IEC-output linearisation method produces from an ISO/IEC-file a linearized display, offset or printer output:

ISO/IEC-input linearisation method			ISO/IEC-output linearisation method			
Input	Output	Application	Input	Output media	Application	
Original scene + CIE colours	ISO/IEC Image File	Reference Image File	ISO/IEC 15775 ISO/IEC TR 24705	ISO/IEC File ISO/IEC File ISO/IEC File	Printer Display Display Offset Printer	ISO/IEC TR 19797 ISO 9241-306:2008 8 viewing conditions CIE RS-09-2015 device space + device-independent visual RGB* space

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