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# Errata to the first printing, *Digital Video and HDTV Algorithms and Interfaces*

This note contains errata to the first printing of the book *Digital Video and HDTV Algorithms and Interfaces*, by Charles Poynton (San Francisco: Morgan Kaufmann, 2003). I encourage you to make these corrections in your copy of the book.

This note contains errata for the first printing. To determine which printing of the book you have, turn to the copyright page of the front matter (page iv) and examine the line starting 2007 2006 … near the bottom of the page. The rightmost digit of that line indicates which printing you have. If you have the second printing or a subsequent printing, I suggest that you obtain the *Errata* for that printing. Although all corrections known at 2008-10-20 are reported here, if you use the appropriate *Errata* you will avoid having to review errors reported here that are printed correctly in your copy.

I revise this note as I discover errors, and I tag each entry with the date it was posted. Prior to your making these corrections, I suggest that you check to see if a more recent *Errata* document has been posted. When you make the corrections herein, I suggest that you annotate, on the copyright page of your book, the *Errata* revision date that you find at the bottom of this page. Then when you check future revisions of this *Errata* document, you can easily identify any additional corrections that need to be made.

www.poynton.com/DVAI/errata

In the entries below, I acknowledge individuals who have reported errors. Corrections without attribution are generally mine. Numerous corrections dated 2002-09-22 are thanks to Erik Garci; several corrections dated 2002-09-23 were reported by Alain Fontaine. Corrections dated 2005-12-11 are thanks to Coe Ishimoto.

2003-02-14: Page xlii of the front matter. Halfway into the second paragraph, correct *Nelson* to *Nelsen.* Sorry, Don!

2003-09-22: Page 7, Figure 1.7. Change *PC/Mac VGA* to *PC/Mac SVGA.*

2005-12-11: Page 9. In Figure 1.11. Change *1920 picture lines* to *1080 picture lines.* Thanks to John Phillips.

2003-09-23: Page 14. In the first two lines of the caption to Figure 1.18, exchange *middle* and *bottom.*

2003-10-15: Page 24. Among the *y*-axis legends of Figure 2.5, replace *235* by *240.* Also, in the fifth line of the text, correct the spelling of *representation.* Thanks to Kunio Kawaguchi.

2005-12-11: Page 29. Replace the caption paragraph to Figure 3.8 with the following (sized to allow you to physically cut and paste):

Figure 3.8 **CONTRAST control in Photoshop** applies a gain factor between zero (for CONTRAST setting of –100) and infinity (for CONTRAST setting of +100) to image data, but "pivoted" around a weighted average of the image data (instead of "pivoting" around zero, as is the case for the CONTRAST control in video). Each component result saturates if it falls outside the range 0 to 255.

2005-12-11: Page 30. Replace the last three lines of the third paragraph with this text:

control does, Photoshop "pivots" the gain adjustment around a weighted average of the image data (0.299 *R'*+0.587 *G'*+0.114 *B'*). The transfer function for a weighted average of 127 is graphed in Figure 3.8.

2003-09-22: Page 59, Table 6.2. Under QXGA, replace *1365* by *1536.*

2003-09-22: Page 74. In the paragraph next to the marginal note, in the fourth line replace *columns* by *rows,* and in the fifth line replace *rows* by *columns.*

2003-09-22: Page 84. In Figure 9.3, change $\gamma_E$=**0.4** to $\gamma_E$=**0.5**.

2006-02-15: Page 89. In line 7 of the first paragraph – immediately opposite the top marginal note – there are two spurious references to *Marginal note,* the result of a cross-referencing error. Replace the first reference with *Equation 10.1* and the second with *Equation 10.2.*

2003-10-15: Page 90. In Figure 10.1, the sketch for 4:1:1 is in error. A replacement figure, with an augmented caption, is provided on page 10 of this document. On page 91, in the third sentence of the first paragraph, change *two* to *three* and insert the two words *vertical and* in front of *horizontal*. In the blank line between the first and second paragraphs, insert this sentence:

> In 4:2:0 DV, $C_B$ and $C_R$ alternate line by line.

Overleaf, on page 92, the lower right corner of Figure 10.2 shows incorrect chroma subsampling for 4:2:0 DV and 4:1:1 DV. A replacement figure is provided on page 10 of this document. Thanks to Guy Bonneau, Don Craig, Patrick Law, and Adam Wilt for helping to accurately document this subsampling mess.

2003-09-22: Page 113. In the last line, change (1080*i*24, 1080*i*30) to (1080*p*24, 1080*p*30).

2005-12-11: Page 114. In the third line of the first paragraph, remove the word *and.*

2005-12-11: Page 115. In the second line of the second paragraph from the bottom, between *increased to 2750* and *achieve* insert *to.*

2003-09-24: Page 134. In the second point, change *CAT 5 coaxial* to *CAT 5e or CAT 6 unshielded twisted pair (UTP).* Thanks to Steve Lampen and Alain Fontaine.

2005-12-11: Page 150. In the third line of the second paragraph, change *identify* to *identity.*

2003-09-23: Page 152. In the penultimate line, and the last line, delete the minus signs in front of each of the two occurrences of $\frac{1}{2}$.

2005-12-11: Page 165. In the second line of the first paragraph, change *ILFP* to *ILPF.*

2003-09-24: Page 172. In the penultimate line of the second paragraph, the mathematician's name is *Lagrange.* Thanks to Alex Ball.

2005-12-11: Page 192. In the third line from the end of the second paragraph, change *ILFP* to *ILPF.*

2003-02-14: Page 196, Figure 19.1. This figure is mistakenly a duplicate of Figure 19.2. The correct figure is provided below, on page 11 of this document.

2003-09-23: Page 201. In the penultimate line, change *90 Td* to *9 Td*.

2003-02-14: Page 202. In the marginal note, correct Robson's first initial from *V* to *J* (for John). You may also wish to correct the index, on page 684. Thanks to Tom Robson, John's son.

2003-02-14: Page 205, Figure 20.1. The scotopic curve should be labelled V′(λ): insert the prime symbol.

2004-08-22: Page 205. Historically, $\bar{y}(\lambda)$ denoted the luminous efficiency function. In the book, I used the notation Y(λ), which was under consideration by the CIE at the time the book was being written. Following publication of the book, the CIE decided to retain the $\bar{y}(\lambda)$ notation. In the bottom paragraph of page 205, in the bottom marginal note on that page, in Figure 20.1, and in the second paragraph of page 206, change Y(λ) to $\bar{y}(\lambda)$.

2004-05-07: Page 207. In the line immediately above Equation 20.1, change *STDV* to *SDTV.* Thanks to Xingbo Wang.

2004-08-22: Page 208. In revising Publ. 15.2 to 15.3, the CIE has changed the coefficients in the equation for *L** to achieve exact *C*0 and *C*1 continuity at the breakpoint between the linear and power-function segments of the function. Insert this marginal note to the left of the paragraph preceding Equation 20.2:

> The fraction $(24/116)^3$ is approximately 0.008856; the fraction $(116/12)^3$ is approximately 903.3. The approximate values were used in CIE Publ. 15.2 (1986).

2004-08-22: Page 208. In Equation 20.2, change 0.008856 to $(24/116)^3$, and change 903.3 to $(116/12)^3$. The new equation is below:

$$L^* = \begin{cases} \left(\dfrac{116}{12}\right)^3 \dfrac{Y}{Y_n}; & \dfrac{Y}{Y_n} \le \left(\dfrac{24}{116}\right)^3 \\ 116\left(\dfrac{Y}{Y_n}\right)^{\frac{1}{3}} - 16; & \left(\dfrac{24}{116}\right)^3 < \dfrac{Y}{Y_n} \end{cases} \qquad \text{Eq 20.2}$$

2004-08-22: Page 209. In the second line of the first full paragraph of the page, change "0.008856 or less" to "$(24/116)^3$ or less, that is, less than about 0.008856."

2005-12-11: Page 214. In the first line of the last paragraph, change *left* to *right.*

2004-08-22: Page 216. Historically, the notation $\bar{x}(\lambda)$, $\bar{y}(\lambda)$, and $\bar{z}(\lambda)$ was used for color matching functions. In the book, I used the notation X(λ), Y(λ), and Z(λ) that was under consideration by the CIE at the time the book was being written. Ultimately the CIE decided to retain $\bar{x}(\lambda)$, $\bar{y}(\lambda)$, and $\bar{z}(\lambda)$. In the bottom paragraph of page 216, in the middle marginal note on that page, in Figure 21.4, in several places on page 217, and in the caption paragraph to Figure 21.5 on page 218, change X(λ), Y(λ), and Z(λ) to $\bar{x}(\lambda)$, $\bar{y}(\lambda)$, and $\bar{z}(\lambda)$ respectively.

2003-10-12: Page 221. In fourth line of the fourth paragraph, replace *Plankian* with *Planckian.* (The scientist's name is spelled Max Planck.)

2004-08-22: Page 225. In Equation 21.3, change 0.008856 to $(^{24}/_{116})^3$, and change 903.3 to $(^{116}/_{12})^3$; the new equation is below. (See the notes above for page 208.)

$$L^* = \begin{cases} \left(\dfrac{116}{12}\right)^3 \dfrac{Y}{Y_n}; & \dfrac{Y}{Y_n} \le \left(\dfrac{24}{116}\right)^3 \\ 116\left(\dfrac{Y}{Y_n}\right)^{\frac{1}{3}} - 16; & \left(\dfrac{24}{116}\right)^3 < \dfrac{Y}{Y_n} \end{cases} \qquad \text{Eq 21.3}$$

2004-08-22: Page 228. In the text immediately below Equation 21.12, change 0.008856 to $(^{24}/_{116})^3$. To the left of that paragraph, insert this marginal note:

> The fraction $(^{24}/_{116})^3$ is approximately 0.008856; the fraction $^{841}/_{108}$ is approximately 7.787. The approximate values were used in CIE Publ. 15.2 (1986).

In Equation 21.13, change 7.787 to $^{841}/_{108}$. The new equation is here:

Eq 21.13

$$\frac{841}{108}t + \frac{16}{116}$$

2008-05-06: Page 239. In the marginal note in the middle of the page, delete *Basic* and capitalize the following *p.*

2003-09-23: Page 250. In second line of the paragraph under Equation 22.6, replace *rows* with *columns.*

2003-02-14: Page 262. In the marginal note at the top of the page, replace the first $\gamma_D$ by $\gamma_E$.

2003-12-16: Page 266, In Equation 23.7, append the digit *5* to the end of the range of applicability of the first line of the equation: The range should read $-0.25 \le L < -0.0045$.

2005-12-11: Page 268. In the second line from the bottom, change *STDV* to *SDTV.*

2003-09-24: Page 291. In the second line of Equation 24.5, replace two instances of *R* with *G;* in the third line, replace two instances of *R* with *B.* Thanks to Lindsay Steele.

2004-07-03: Page 310. Replace Equation 25.12. Thanks to Andrew Murray and Masaki Kato. Beware that a previous correction to this matrix gave incorrect values:

Eq 25.12

$$\begin{bmatrix} {}^{601}_{255}Y' \\ C_B \\ C_R \end{bmatrix} = \frac{1}{256}\begin{bmatrix} 76.245 & 149.685 & 29.07 \\ -43.366 & -85.136 & 128.502 \\ 128.502 & -107.604 & -20.898 \end{bmatrix} \bullet \begin{bmatrix} {}_{255}R' \\ {}_{255}G' \\ {}_{255}B' \end{bmatrix}$$

2003-09-24: Page 319. Replace Equation 26.9:

Eq 26.9

$$\begin{bmatrix} {}_{219}R' \\ {}_{219}G' \\ {}_{219}B' \end{bmatrix} = \frac{1}{256}\begin{bmatrix} 256 & 0 & 394.150 \\ 256 & -46.885 & -117.165 \\ 256 & 464.430 & 0 \end{bmatrix} \bullet \left( \begin{bmatrix} {}^{709}_{219}Y' \\ C_B \\ C_R \end{bmatrix} - \begin{bmatrix} 16 \\ 128 \\ 128 \end{bmatrix} \right)$$

Replace Equation 26.10:

Eq 26.10

$$\begin{bmatrix} {}^{709}_{219}Y' \\ C_B \\ C_R \end{bmatrix} = \begin{bmatrix} 16 \\ 128 \\ 128 \end{bmatrix} + \frac{1}{256}\begin{bmatrix} 46.742 & 157.243 & 15.874 \\ -25.765 & -86.674 & 112.439 \\ 112.439 & -102.129 & -10.310 \end{bmatrix} \bullet \begin{bmatrix} {}_{255}R' \\ {}_{255}G' \\ {}_{255}B' \end{bmatrix}$$

In the line immediately below Equation 26.10, replace *601* by *709.* Thanks to James Tyson and Mike Meyers.

2003-09-24: Page 320. Equation 26.12 is in error; replace it with this:

$$\begin{bmatrix} {}^{601}_{219}Y' \\ C_B \\ C_R \end{bmatrix} = \begin{bmatrix} 1 & 0.099312 & 0.191700 \\ 0 & 0.989854 & -0.110653 \\ 0 & -0.072453 & 0.983398 \end{bmatrix} \bullet \begin{bmatrix} {}^{709}_{219}Y' \\ C_B \\ C_R \end{bmatrix} \quad \text{Eq 26.12}$$

Equation 26.13 is in error; replace it as follows:

$$\begin{bmatrix} {}^{709}_{219}Y' \\ C_B \\ C_R \end{bmatrix} = \begin{bmatrix} 1 & -0.115550 & -0.207938 \\ 0 & 1.018640 & 0.114618 \\ 0 & 0.075049 & 1.025327 \end{bmatrix} \bullet \begin{bmatrix} {}^{601}_{219}Y' \\ C_B \\ C_R \end{bmatrix} \quad \text{Eq 26.13}$$

Thanks to Victor Duvanenko for discovering both of these errors.

2005-12-11: Page 335. In the second line of the last paragraph, delete the word *is.*

2005-08-25: Page 343. In the paragraph commencing "The V-axis switch," Walter Bruch's surname is mistakenly written with an umlaut. Please remove it – *Bruch.* Thanks to Benjamin Spitschan.

2003-02-14: Page 363, paragraph 2, line 3. Delete the italicized *a*.

2005-12-11: Page 371. In the second line from the end of the first paragraph, change *HTDV* to *HDTV.*

2003-02-14: Page 379, paragraph 2, line 4. Change *16 seconds* to *33.367 seconds.* Thanks to Erik Garci.

2004-03-04: Page 383. The paragraph adjacent to Figure 32.2 should reference that figure, not Figure 31.2. Thanks to Don Orofino.

2005-12-11: Page 398. In the second line of the third paragraph, change *potion* to *portion.*

2006-06-28: Page 432. In the top paragraph, change "one field frame to another. This" to "one field to another. The switch."

2003-09-22: Page 432. In the second line of the last paragraph, change *video frame rate* to *video field rate.*

2003-09-22: Page 437. In the bottom paragraph, delete the word *in* at the start of the fourth line.

2003-09-24: Page 440. The first word of the caption to Figure 37.12 should read *Intrafield.* If you're a stickler for detail, change the List of Figures (page xxxii) accordingly. Thanks to David Salotti.

2003-09-24: Page 442. Figure 37.15 mistakenly has three stages instead of four; a replacement figure is provided on page 11 of this document. In the third line of the top paragraph of the page, replace *three* by *four* in two places. Thanks to Mike O'Connell and Billy Biggs.

2003-09-23: Page 448. In the caption to Figure 38.1, replace *a luma block* with *four luma blocks.*

2003-02-14: Page 448. In the third line from bottom, insert *of* between *array* and *the spatial.*

2005-12-11: Page 453. In the last line of the last paragraph, between *represented* and *fewer bits,* insert *by.*

2003-10-15: Page 462. Replace the middle paragraph and the associated marginal note with this (formatted to cut and paste):

SMPTE 314M defines DV25 and DV50 for studio use. The Blue Book, and IEC standards, use the word *decimated* instead of *discarded.* IEC 61834-1, cited in the margin of page 422, prescribes the subsampling schemes for consumer DV.

> SMPTE 314M declares that in subsampling 4:2:2 to 4:1:1, "every other pixel is discarded." Obviously, high image quality requires that proper filtering be performed before discarding samples. In DV, $C_B$ and $C_R$ samples coincide with luma both horizontally and vertically. However, in the 4:2:0 scheme used in 576*i* consumer equipment, $C_R$ samples are not sited at the same locations as $C_B$ samples. Instead, $C_B$ and $C_R$ samples are sited in line-alternate vertical positions throughout each field: Each $C_B$ sample is centered two image rows below an associated $C_R$ sample.

2003-09-22: Page 506. In second marginal equation, change the first and third minus signs to plus:

$$41.259 \approx \frac{63.55\overline{5}}{2} + \frac{858 - 732 + 2}{13.5}$$

2005-12-11: Page 517. In the first line of the last paragraph, change *above* to *overleaf.*

2005-08-25: Page 530. In the second paragraph and in the third paragraph, Walter Bruch's surname is mistakenly written with an umlaut. Please remove them: *Bruch.* Thanks to Benjamin Spitschan.

2003-09-22: Page 535. In the third line of the second paragraph, replace *100%* by *75%.*

2005-03-19: Page 543. Replace the marginal note:

The risetime (from 10% to 90%) of *a T* pulse is about 0.59 times the risetime of a *T* step:

$$t_R = \frac{2\sin^{-1}(0.9 - 0.1)}{\pi} t_{HAD} \approx 0.59 t_{HAD}$$

Consequently, the frequency spectrum occupancy of a *T* pulse is about $1/_{0.59}$, or 1.7 times, greater than that of a *T* step. A 2*T* pulse has a risetime about 1.18 times the risetime of a *T* step.

2008-10-20: Page 543. In Eq 45.2, change $3t^3 - 2t^2$ to $-2t^3 + 3t^2$. Thanks to Jay Zipnick.

2006-03-01: Page 550. In Figure 46.1, *35 H* should read *25 H.* Thanks to Kylo Ginsberg.

2006-04-03: Page 558. In the top three body rows of Table 47.1, three occurrences of *148* should read *148.5.* Thanks to Benjamin Spitschan.

2004-07-06: Page 559, Table 47.2. In the columns *Contents, left half* and *Contents, right half,* blank out all the entries that contain *tri/none* or *tri/BR.* Don't forget the bottom row. A replacement table is provided on page 12 of this document. These entries are correct for interlace, but inapplicable (and therefore confusing) for progressive. The same information is presented more clearly in Figure 47.2.

2006-03-01: Page 559, Table 47.2. Delete the entry *563* from the top body line of the table; insert a new bottom body line containing *563* under the column head *Line number, first field* (*F* = 0). This change clarifies that during video line 563 the F-bit is deasserted.A replace-

ment table is provided on page 12 of this document. Thanks to Kylo Ginsberg.

2004-07-06: Page 561. The first two lines of the fourth paragraph are printed correctly. However, in a previous *Errata* document, I wrongly suggested changing *five* to *ten* in the first line and *one* to *two* in the second. The proper correction is to Figure 47.2, as noted in the entry below. (I thought I was wrong once, but I was mistaken!)

2004-07-06: Page 564, Figure 47.2. In the progressive system, change successive pairs of broad pulses to a single pulse. A replacement figure is provided on page 13 of this document. Thanks to Erik Garci, Jason Griffin, and Pierre Berthet.

2004-07-03: Page 573. In the last line of the first paragraph under the heading *Audio in NTSC*, change *25* to *75.* Thanks to William Hooper.

2003-09-22: Page 582. In the penultimate line, change *262p60.05* to *262/60.05/1:1,* and in the last line, change *312p50.08* to *312/50.08/1:1.*

2003-09-22: Page 589. In the top marginal note, change *704* to *720.* Adjacent to the second paragraph, add this marginal note:

> As an alternative to downsampling, analog scanning can cover ¾ of the height of the 4:3 screen to yield a picture aspect ratio of 16:9.

2004-05-07: Page 601. In the first line of the caption of Table B.1, change *In radiometry* to *In photometry.* Thanks to Xingbo Wang.

2007-06-01: Page 613. Under *Alpha,* change *transparency* to *opacity;* change *zero (opaque)* to *black* (*0, fully transparent*); and change *unity* (*fully transparent*) to *white* (*1, fully opaque*).

2007-06-01: Page 634. Under *Key,* change *transparency* to *opacity*.

## Replacement figures

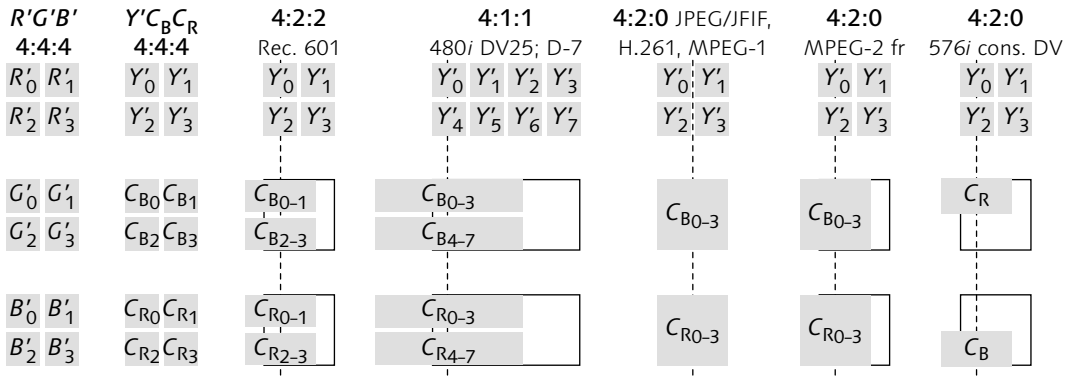
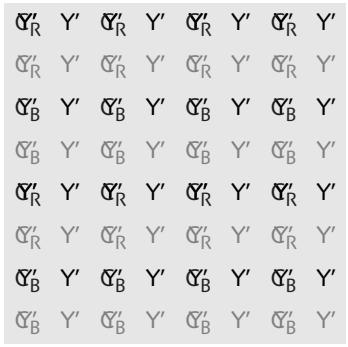
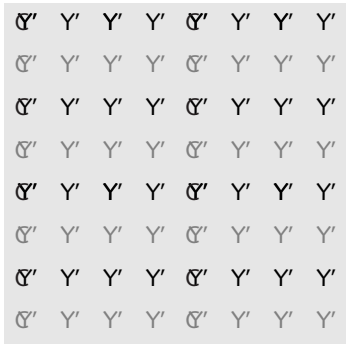



Figure 10.1 **Chroma subsampling.** A 2×2 array of *R′G′B′* pixels is matrixed into a luma component *Y′* and two color difference components $C_B$ and $C_R$. Color detail is reduced by subsampling $C_B$ and $C_R$; providing full luma detail is maintained, no degradation is perceptible. In this sketch, samples are shaded to indicate their spatial position and extent. In 4:2:2, in 4:1:1, and in 4:2:0 used in MPEG-2, $C_B$ and $C_R$ are cosited (positioned horizontally coincident with a luma sample). In 4:2:0 used in JPEG/JFIF, H.261, and MPEG-1, $C_B$ and $C_R$ are sited interstitially (midway between luma samples). In the 4:2:0 variant used in consumer 576*i* DV, $C_B$ and $C_R$ are vertically sited in line-alternate fashion in each field (starting with *a* $C_R$ sample sited over the top left luma sample.)



**4:2:0 DV**
interlaced



**4:1:1 DV**
interlaced

Figure 10.2 (*lower right-hand portion*)

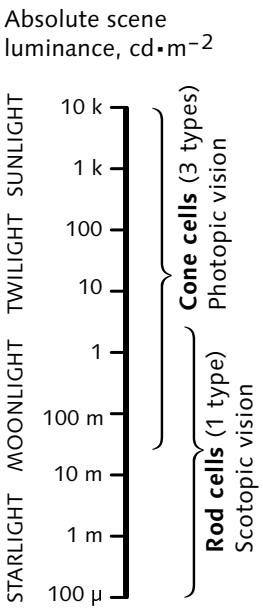



Figure 19.1 **Luminance range of vision**

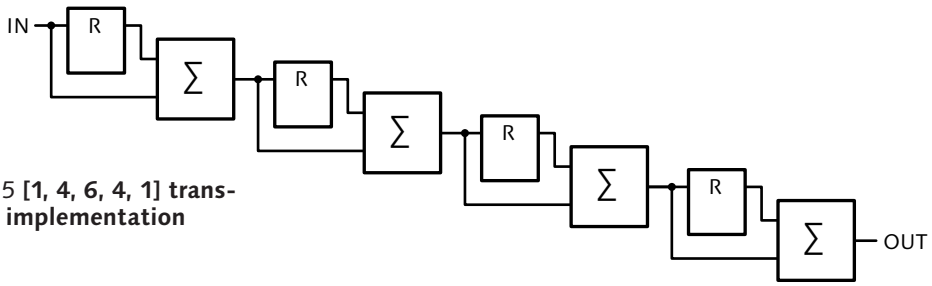



Figure 37.15 **[1, 4, 6, 4, 1] transverse filter implementation**

| *Line number, progressive* | *Line number, first field (F = 0)* | *Line number, second field (F = 1)* | *V* | *Contents, left half* | *Contents, right half* |
|---|---|---|---|---|---|
| 1 | 1 | | | | |
| | | 564 | | | |
| 2 | 2 | | | | |
| | | 565 | | | |
| 3 | 3 | | | | |
| | | 566 | | | |
| 4 | 4 | | | | |
| | | 567 | | | |
| 5 | 5 | | | | |
| | | 568 | | | |
| 6 | 6 | | | | |
| | 7–20 (14 lines) | | | vertical interval video | |
| 7–41 (35 lines) | | 569–583 (15 lines) | | vertical interval video | |
| | 21–560 (540 lines) | | *V* = 0 (1080 lines) | picture[a,b] | |
| 42–1121 (1080 lines) | | | | | |
| | | 584–1123 (540 lines) | | picture | |
| 1122–1125 (4 lines) | 561–562 (2 lines) | 1124–1125 (2 lines) | | | |
| | 563 | | | | |

a In 1035*i* systems, picture occupies 517 lines (41 through 557) in the first field, and 518 lines (603 through 1120) in the second field. Other lines are blank, with V = 1. Picture is centered vertically on line 258 of the first field.

b In the 1024*i*30.00 variant of DV HD, described on page 469, picture lines 44 through 555 of the first (top) field and picture lines 606 through 1117 of the second (bottom) field are carried.

Table 47.2 **1080*i* and 1080*p* line assignment**

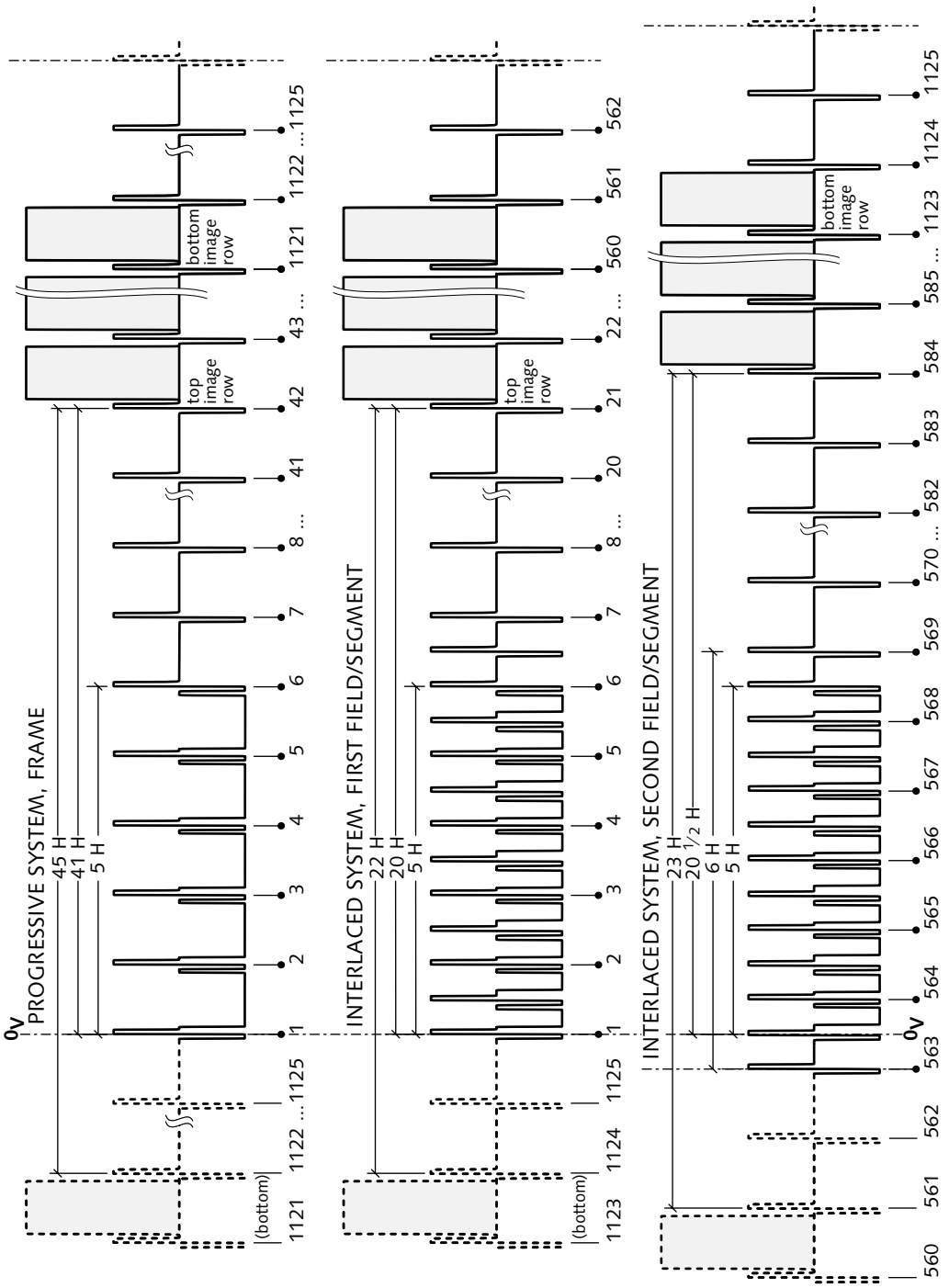



Figure 47.2 **1080*i* and 1080*p* vertical blanking interval**