lyche-numerical-linear-algebra: residuals

equations measured 2026-09-05T12:57:29Z against the model of 2026-09-01

Corrected (8)

<table>
<tr><th>Identifier</th><th>Page</th><th>Conf.</th><th>LaTeX source</th><th>Rendered</th><th>Scan image</th></tr>
<tr>
<td>lyche-numerical-linear-algebra_
EQ0326 (was)</td>
<td>133</td>
<td>■ 0.118</td>
<td><code>\begin{aligned} & \boldsymbol{Q}_{1}:=\left[\begin{array}{llll} \boldsymbol{q}_{1}, \ldots, \boldsymbol{q}_{n} \end{array}\right], \\ & \boldsymbol{R}_{1}:= \\ & \boldsymbol{q}_{j}:=\frac{ \boldsymbol{v}_{j}}{\left\|\boldsymbol{v}_{j}\right \|_{2}}, \quad j=1, \ldots, n \text { and } \\ & {\left[\begin{array}{ccccc} \left\|\boldsymbol{v}_{1}\right \|_{2} & \boldsymbol{a}_{2}^{T} \boldsymbol{q}_{1} & \boldsymbol{a}_{3}^{T} \boldsymbol{q}_{1} & \cdots & \boldsymbol{a}_{n-1}^{T} \boldsymbol{q}_{1} \\ 0 & \left \|\boldsymbol{v}_{2}\right\|_{2} & \boldsymbol{a}_{3}^{T} \boldsymbol{q}_{2} & \cdots & \boldsymbol{a}_{n-1}^{T} \boldsymbol{q}_{2} \\ & 0 & \left\|\boldsymbol{v}_{3} \right\|_{2} & \cdots & \boldsymbol{a}_{n-1}^{T} \boldsymbol{q}_{2} \\ & & \ddots & \ddots & \boldsymbol{a}_{n}^{T} \boldsymbol{q}_{3} \\ & & & \ddots & \vdots \\ & & & \left\|\boldsymbol{v}_{n-1}\right\|_{2} & \boldsymbol{a}_{n}^{T} \boldsymbol{q}_{n-1} \\ & & & 0 & \left\|\boldsymbol{v}_{n}\right\|_{2} \end{array} \right] .} \end{aligned}</code></td>
<td>$Q_1 := \left[\ q_1, \ldots, q_n\ \right],$
$R_1 :=$
$q_j := \frac{v_j}{\|v_j\|_2}, \quad j = 1, \ldots, n$ and
$\left[\begin{array}{ccccc} \|v_1\|_2 & a_2^T q_1 & a_3^T q_1 & \cdots & a_{n-1}^T q_1 \\ 0 & \|v_2\|_2 & a_3^T q_2 & \cdots & a_{n-1}^T q_2 \\ & 0 & \|v_3\|_2 & \cdots & a_{n-1}^T q_2 \\ & & \ddots & \ddots & a_n^T q_3 \\ & & & \ddots & \vdots \\ & & & \|v_{n-1}\|_2 & a_n^T q_{n-1} \\ & & & 0 & \|v_n\|_2 \end{array} \right].$</td>
<td>$\boldsymbol{Q}_1 := [\boldsymbol{q}_1, \ldots, \boldsymbol{q}_n], \quad \boldsymbol{q}_j := \frac{\boldsymbol{v}_j}{\|\boldsymbol{v}_j\|_2}, \quad j = 1, \ldots, n$ *and*
$\boldsymbol{R}_1 := \begin{bmatrix} \|\boldsymbol{v}_1\|_2 & \boldsymbol{a}_2^T \boldsymbol{q}_1 & \boldsymbol{a}_3^T \boldsymbol{q}_1 & \cdots & \boldsymbol{a}_{n-1}^T \boldsymbol{q}_1 & \boldsymbol{a}_n^T \boldsymbol{q}_1 \\ 0 & \|\boldsymbol{v}_2\|_2 & \boldsymbol{a}_3^T \boldsymbol{q}_2 & \cdots & \boldsymbol{a}_{n-1}^T \boldsymbol{q}_2 & \boldsymbol{a}_n^T \boldsymbol{q}_2 \\ & 0 & \|\boldsymbol{v}_3\|_2 & \cdots & \boldsymbol{a}_{n-1}^T \boldsymbol{q}_3 & \boldsymbol{a}_n^T \boldsymbol{q}_3 \\ & & \ddots & \ddots & \vdots & \vdots \\ & & & \ddots & \|\boldsymbol{v}_{n-1}\|_2 & \boldsymbol{a}_n^T \boldsymbol{q}_{n-1} \\ & & & & 0 & \|\boldsymbol{v}_n\|_2 \end{bmatrix}.$</td>
</tr>
</table>

Conf. MathPix confidence: ■ ≥0.9 ■ 0.5–0.9 ■ <0.5 — no value

LaTeX source MathPix's reading, unchanged; **Rendered** the same reading, with a display environment (align/alignat/flalign/eqnarray/gather/multline/split) mapped to its in-math form so it can typeset in this cell — the two may legitimately differ

Residual render vs scan (inkdrill): • C component • W weak • S stable • N noise • K clean • not measured

[refined: *basis*] beside an identifier: the LaTeX-source and Rendered cells both show a VERIFIED refinement, not MathPix's own reading — *basis* names what verified it (e.g. ink, source). The original reading is unchanged in the model but is not the one drawn here.

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<tr><td>lyche-numerical-linear-algebra_
EQ0326 (now)</td><td>133</td><td>—</td><td>\begin{aligned} & \boldsymbol{Q}_{1}:=\left[\boldsymbol{q}_{1}, \ldots, \boldsymbol{q}_{n}\right], \quad \boldsymbol{q}_{j}:=\frac{\boldsymbol{v}_{j}}{ \left\|\boldsymbol{v}_{j}\right\|_{2}}, \quad j=1, \ldots, n \text{ and} \\ & \boldsymbol{R}_{1}:=\left[\begin{array}{cccccc} \left\|\boldsymbol{v}_{1}\right \|_{2} & \boldsymbol{a}_{2}^{T} \boldsymbol{q}_{1} & \boldsymbol{a}_{3}^{T} \boldsymbol{q}_{1} & \cdots & \boldsymbol{a}_{n-1}^{T} \boldsymbol{q}_{1} & \boldsymbol{a}_{n}^{T} \boldsymbol{q}_{1} \\ 0 & \left\|\boldsymbol{v}_{2}\right\|_{2} & \boldsymbol{a}_{3}^{T} \boldsymbol{q}_{2} & \cdots & \boldsymbol{a}_{n-1}^{T} \boldsymbol{q}_{2} & \boldsymbol{a}_{n}^{T} \boldsymbol{q}_{2} \\ & 0 & \left\|\boldsymbol{v}_{3}\right\|_{2} & \cdots & \boldsymbol{a}_{n-1}^{T} \boldsymbol{q}_{3} & \boldsymbol{a}_{n}^{T} \boldsymbol{q}_{3} \\ & & \ddots & \ddots & \vdots & \vdots \\ & & & \ddots & \left\|\boldsymbol{v}_{n-1}\right\|_{2} & \boldsymbol{a}_{n}^{T} \boldsymbol{q}_{n-1} \\ & & & & 0 & \left\|\boldsymbol{v}_{n}\right\|_{2} \end{array} \right]. \end{aligned}</td><td>$\boldsymbol{Q}_{1}:=\left[\boldsymbol{q}_{1}, \ldots, \boldsymbol{q}_{n}\right], \quad \boldsymbol{q}_{j}:=\frac{\boldsymbol{v}_{j}}{ \left\|\boldsymbol{v}_{j}\right\|_{2}}, \quad j=1, \ldots, n \text{ and}$
$\boldsymbol{R}_{1}:=\left[\begin{array}{cccccc} \left\|\boldsymbol{v}_{1}\right \|_{2} & \boldsymbol{a}_{2}^{T} \boldsymbol{q}_{1} & \boldsymbol{a}_{3}^{T} \boldsymbol{q}_{1} & \cdots & \boldsymbol{a}_{n-1}^{T} \boldsymbol{q}_{1} & \boldsymbol{a}_{n}^{T} \boldsymbol{q}_{1} \\ 0 & \left\|\boldsymbol{v}_{2}\right\|_{2} & \boldsymbol{a}_{3}^{T} \boldsymbol{q}_{2} & \cdots & \boldsymbol{a}_{n-1}^{T} \boldsymbol{q}_{2} & \boldsymbol{a}_{n}^{T} \boldsymbol{q}_{2} \\ & 0 & \left\|\boldsymbol{v}_{3}\right\|_{2} & \cdots & \boldsymbol{a}_{n-1}^{T} \boldsymbol{q}_{3} & \boldsymbol{a}_{n}^{T} \boldsymbol{q}_{3} \\ & & \ddots & \ddots & \vdots & \vdots \\ & & & \ddots & \left\|\boldsymbol{v}_{n-1}\right\|_{2} & \boldsymbol{a}_{n}^{T} \boldsymbol{q}_{n-1} \\ & & & & 0 & \left\|\boldsymbol{v}_{n}\right\|_{2} \end{array} \right].$</td><td>$\boldsymbol{Q}_{1}:=[\boldsymbol{q}_{1}, \ldots, \boldsymbol{q}_{n}], \quad \boldsymbol{q}_{j}:=\frac{\boldsymbol{v}_{j}}{\|\boldsymbol{v}_{j}\|_{2}}, \quad j=1, \ldots, n \textit{ and}$
$\boldsymbol{R}_{1}:=\left[\begin{array}{cccccc} \|\boldsymbol{v}_{1}\|_{2} & \boldsymbol{a}_{2}^{T} \boldsymbol{q}_{1} & \boldsymbol{a}_{3}^{T} \boldsymbol{q}_{1} & \cdots & \boldsymbol{a}_{n-1}^{T} \boldsymbol{q}_{1} & \boldsymbol{a}_{n}^{T} \boldsymbol{q}_{1} \\ 0 & \|\boldsymbol{v}_{2}\|_{2} & \boldsymbol{a}_{3}^{T} \boldsymbol{q}_{2} & \cdots & \boldsymbol{a}_{n-1}^{T} \boldsymbol{q}_{2} & \boldsymbol{a}_{n}^{T} \boldsymbol{q}_{2} \\ & 0 & \|\boldsymbol{v}_{3}\|_{2} & \cdots & \boldsymbol{a}_{n-1}^{T} \boldsymbol{q}_{3} & \boldsymbol{a}_{n}^{T} \boldsymbol{q}_{3} \\ & & \ddots & \ddots & \vdots & \vdots \\ & & & \ddots & \|\boldsymbol{v}_{n-1}\|_{2} & \boldsymbol{a}_{n}^{T} \boldsymbol{q}_{n-1} \\ & & & & 0 & \|\boldsymbol{v}_{n}\|_{2} \end{array} \right].$</td></tr>
<tr><td colspan="6">basis: inferred / ink</td></tr>
<tr><td>lyche-numerical-linear-algebra_
EQ0369 (was)</td><td>150</td><td>■ 0.298</td><td>\boldsymbol{J}:=\operatorname{diag}\left(\boldsymbol{U}_{1}, \boldsymbol{U}_{2}\right)=\left[\begin{array}{ccccccc} 2 & 1 & 0 & & & & \\ 0 & 2 & 1 & & & & \\ 0 & 0 & 2 & & 1 & & \\ & & 0 & 1 & & \\ & & 0 & 2 & & & \\ & & & & & 0 & \\ & & & & & 0 & 1 \end{array} \right] \in \mathbb{R}^{8 \times 8} .</td><td>$\boldsymbol{J}:=\operatorname{diag}\left(\boldsymbol{U}_{1}, \boldsymbol{U}_{2}\right)=\left[\begin{array}{ccccccc} 2 & 1 & 0 & & & & \\ 0 & 2 & 1 & & & & \\ 0 & 0 & 2 & & 1 & & \\ & & 0 & 1 & & \\ & & 0 & 2 & & & \\ & & & & & 0 & \\ & & & & & 0 & 1 \end{array} \right] \in \mathbb{R}^{8 \times 8} .$</td><td>$\boldsymbol{J}:=\operatorname{diag}(\boldsymbol{U}_{1}, \boldsymbol{U}_{2})=\left[\begin{array}{cccccccc} 2 & 1 & 0 & & & & & \\ 0 & 2 & 1 & & & & & \\ 0 & 0 & 2 & & & & & \\ & & & 2 & 1 & & & \\ & & & 0 & 2 & & & \\ & & & & & 2 & & \\ & & & & & & 3 & 1 \\ & & & & & & 0 & 3 \end{array} \right] \in \mathbb{R}^{8 \times 8}.$</td></tr>
<tr><td>lyche-numerical-linear-algebra_
EQ0369 (now)</td><td>150</td><td>—</td><td>d_i for i = 1, \ldots, n, b_{i+1,i} := a_i, b_{i,i+1} := c_i for i \text{otherwise.} \in \mathbb{C}^{m \times n} and 1 \le i_1 < i_2 < \cdots < i_r \le m, 1 \le j \text{matrix } A(\boldsymbol{i}, \boldsymbol{j}) \in \mathbb{C}^{r \times c} \text{ is the submatrix of } A \text{ c}</td><td>$d_i for i = 1, \ldots, n, b_{i+1,i} := a_i, b_{i,i+1} := c_i for i \text{otherwise.} \in \mathbb{C}^{m \times n} and 1 \le i_1 < i_2 < \cdots < i_r \le m, 1 \le j \text{matrix } A(\boldsymbol{i}, \boldsymbol{j}) \in \mathbb{C}^{r \times c} \text{ is the submatrix of } A \text{ c}$</td><td>$\boldsymbol{J}:=\operatorname{diag}(\boldsymbol{U}_{1}, \boldsymbol{U}_{2})=\left[\begin{array}{cccccccc} 2 & 1 & 0 & & & & & \\ 0 & 2 & 1 & & & & & \\ 0 & 0 & 2 & & & & & \\ & & & 2 & 1 & & & \\ & & & 0 & 2 & & & \\ & & & & & 2 & & \\ & & & & & & 3 & 1 \\ & & & & & & 0 & 3 \end{array} \right] \in \mathbb{R}^{8 \times 8}.$</td></tr>
<tr><td colspan="6">basis: inferred / ink</td></tr>
<tr><td colspan="6">Conf. MathPix confidence: ■ ≥0.9 ■ 0.5–0.9 ■ <0.5 — no value
LaTeX source MathPix's reading, unchanged; Rendered the same reading, with a display environment (align/alignat/flalign/eqnarray/gather/multline/split) mapped to its in-math form so it can typeset in this cell — the two may legitimately differ
Residual render vs scan (inkdrill): • C component • W weak • S stable • N noise • K clean • not measured
[refined: basis] beside an identifier: the LaTeX-source and Rendered cells both show a VERIFIED refinement, not MathPix's own reading — basis names what verified it (e.g. ink, source). The original reading is unchanged in the model but is not the one drawn here.</td></tr>
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<tr>
<td>lyche-numerical-linear-algebra_ EQ0579 (was)</td>
<td>215</td>
<td>■ 0.322</td>
<td><code>\begin{aligned} \boldsymbol{A}^{*} \boldsymbol{A} \boldsymbol{x} & =\left[\begin{array}{ccc} 1 & \cdots & 1 \\ t_{1} & \cdots & t_{m} \end{array}\right]\left[\begin{array}{c} 1 \\ \vdots \\ 1 \\ 1 \\ m \end{array} \right]\left[\begin{array}{l} x_{1} \\ x_{2} \end{array} \right]=\left[\begin{array}{cc} m & \sum t_{k} \\ \sum t_{k} & \sum t_{k}^{2} \end{array}\right]\left[\begin{array}{l} x_{1} \\ x_{2} \end{array}\right], \\ & =\left[\begin{array}{ccc} 1 & \cdots & 1 \\ t_{1} & \cdots & t_{m} \end{array}\right]\left[\begin{array}{c} y_{1} \\ \vdots \\ y_{m} \end{array}\right]=\left[\begin{array}{c} \sum y_{k} \\ \sum t_{k} y_{k} \end{array}\right]=\boldsymbol{A}^{*} \boldsymbol{b}, \end{aligned}</code></td>
<td>$$\begin{aligned} \boldsymbol{A}^{*} \boldsymbol{A} \boldsymbol{x} & =\left[\begin{array}{ccc} 1 & \cdots & 1 \\ t_{1} & \cdots & t_{m} \end{array}\right]\left[\begin{array}{c} 1 \\ \vdots \\ 1 \\ 1 \\ m \end{array} \right]\left[\begin{array}{l} x_{1} \\ x_{2} \end{array} \right]=\left[\begin{array}{cc} m & \sum t_{k} \\ \sum t_{k} & \sum t_{k}^{2} \end{array}\right]\left[\begin{array}{l} x_{1} \\ x_{2} \end{array}\right], \\ & =\left[\begin{array}{ccc} 1 & \cdots & 1 \\ t_{1} & \cdots & t_{m} \end{array}\right]\left[\begin{array}{c} y_{1} \\ \vdots \\ y_{m} \end{array}\right]=\left[\begin{array}{c} \sum y_{k} \\ \sum t_{k} y_{k} \end{array}\right]=\boldsymbol{A}^{*} \boldsymbol{b}, \end{aligned}$$</td>
<td>$$\begin{aligned} \boldsymbol{A}^{*} \boldsymbol{A} \boldsymbol{x} & =\begin{bmatrix} 1 & \cdots & 1 \\ t_{1} & \cdots & t_{m} \end{bmatrix}\begin{bmatrix} 1 & t_1 \\ \vdots & \\ 1 & t_m \end{bmatrix}\begin{bmatrix} x_{1} \\ x_{2} \end{bmatrix}=\begin{bmatrix} m & \sum t_{k} \\ \sum t_{k} & \sum t_{k}^{2} \end{bmatrix}\begin{bmatrix} x_{1} \\ x_{2} \end{bmatrix}, \\ & =\begin{bmatrix} 1 & \cdots & 1 \\ t_{1} & \cdots & t_{m} \end{bmatrix}\begin{bmatrix} y_{1} \\ \vdots \\ y_{m} \end{bmatrix}=\begin{bmatrix} \sum y_{k} \\ \sum t_{k} y_{k} \end{bmatrix}=\boldsymbol{A}^{*} \boldsymbol{b}, \end{aligned}$$</td>
</tr>
<tr>
<td>lyche-numerical-linear-algebra_ EQ0579 (now)</td>
<td>215</td>
<td>—</td>
<td><code>\text{nal if } a_{ij} = 0 \text{ for } i \neq j. \\ \text{triangular or \textbf{right triangular} if } a_{ij} = 0 \text{ for } i > j. \\ \text{triangular or \textbf{left triangular} if } a_{ij} = 0 \text{ for } i < j. \\ \textbf{Hessenberg if } a_{ij} = 0 \text{ for } i > j + 1. \\ \textbf{Hessenberg if } a_{ij} = 0 \text{ for } i < j + 1. \\ \text{gonal if } a_{ij} = 0 \text{ for } |i - j| > 1. \\ \text{ded if } a_{ij} = 0 \text{ for } |i - j| > d. \\[1ex] \text{the following notations for diagonal- and tridiagonal } n \times n</code></td>
<td>(not rendered)</td>
<td>$$\begin{aligned} \boldsymbol{A}^{*} \boldsymbol{A} \boldsymbol{x} & =\begin{bmatrix} 1 & \cdots & 1 \\ t_{1} & \cdots & t_{m} \end{bmatrix}\begin{bmatrix} 1 & t_1 \\ \vdots & \\ 1 & t_m \end{bmatrix}\begin{bmatrix} x_{1} \\ x_{2} \end{bmatrix}=\begin{bmatrix} m & \sum t_{k} \\ \sum t_{k} & \sum t_{k}^{2} \end{bmatrix}\begin{bmatrix} x_{1} \\ x_{2} \end{bmatrix}, \\ & =\begin{bmatrix} 1 & \cdots & 1 \\ t_{1} & \cdots & t_{m} \end{bmatrix}\begin{bmatrix} y_{1} \\ \vdots \\ y_{m} \end{bmatrix}=\begin{bmatrix} \sum y_{k} \\ \sum t_{k} y_{k} \end{bmatrix}=\boldsymbol{A}^{*} \boldsymbol{b}, \end{aligned}$$</td>
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Identifier	Page	Conf.	LaTeX source	Rendered	Scan image
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\boldsymbol{v}_{i} \end{array}\right]=- \alpha_{i}\left[\begin{array}{c} \boldsymbol{u}_{i} \\ -\boldsymbol{v}_{i} \end{array}\right], \quad i=1, \ldots, r, \\ {\left[\begin{array}{cc} \mathbf{0} & \boldsymbol{A} \\ \boldsymbol{A}^{*} & \mathbf{0} \end{array}\right]\left[\begin{array}{c} \boldsymbol{u}_{i} \\ \mathbf{0} \end{array}\right] } & = \left[\begin{array}{c} \mathbf{0} \\ \boldsymbol{A}^{*} \boldsymbol{u}_{i} \end{array}\right]=\left[\begin{array}{l} \mathbf{0} \\ \mathbf{0} \end{array} \right]=0\left[\begin{array}{c} \boldsymbol{u}_{i} \\ \mathbf{0} \end{array}\right], \quad i=r+1, \ldots, m, \\ {\left[\begin{array}{cc} \mathbf{0} & \boldsymbol{A} \\ \boldsymbol{A}^{*} & \mathbf{0} \end{array}\right]\left[\begin{array}{c} \mathbf{0} \\ \boldsymbol{v}_{i} \end{array}\right] } & =\left[\begin{array}{c} \boldsymbol{A} \boldsymbol{v}_{i} \\ \mathbf{0} \end{array}\right]=\left[\begin{array}{l} \mathbf{0} \\ \mathbf{0} \end{array}\right]=0\left[\begin{array}{c} \mathbf{0} \\ \boldsymbol{v}_{i} \end{array}\right], \quad i=r+1, \ldots, n \end{aligned}	$\begin{aligned} \left[\begin{array}{cc} \boldsymbol{0} & \boldsymbol{A} \\ \boldsymbol{A}^{*} & \boldsymbol{0} \end{array}\right]\left[\begin{array}{l} \boldsymbol{u}_{i} \\ \boldsymbol{v}_{i} \end{array}\right] &= \left[\begin{array}{c} \boldsymbol{A} \boldsymbol{v}_{i} \\ \boldsymbol{A}^{*} \boldsymbol{u}_{i} \end{array}\right] = \left[\begin{array}{l} \alpha_{i} \boldsymbol{u}_{i} \\ \alpha_{i} \boldsymbol{v}_{i} \end{array}\right] = \alpha_{i}\left[\begin{array}{l} \boldsymbol{u}_{i} \\ \boldsymbol{v}_{i} \end{array}\right], \quad i=1, \ldots, r, \\ \left[\begin{array}{cc} \mathbf{0} & \boldsymbol{A} \\ \boldsymbol{A}^{*} & \mathbf{0} \end{array}\right]\left[\begin{array}{c} \boldsymbol{u}_{i} \\ -\boldsymbol{v}_{i} \end{array}\right] &= \left[\begin{array}{c} -\boldsymbol{A} \boldsymbol{v}_{i} \\ \boldsymbol{A}^{*} \boldsymbol{u}_{i} \end{array}\right] = \left[\begin{array}{c} -\alpha_{i} \boldsymbol{u}_{i} \\ \alpha_{i} \boldsymbol{v}_{i} \end{array}\right] = -\alpha_{i}\left[\begin{array}{c} \boldsymbol{u}_{i} \\ -\boldsymbol{v}_{i} \end{array}\right], \quad i=1, \ldots, r, \\ \left[\begin{array}{cc} \mathbf{0} & \boldsymbol{A} \\ \boldsymbol{A}^{*} & \mathbf{0} \end{array}\right]\left[\begin{array}{c} \boldsymbol{u}_{i} \\ \mathbf{0} \end{array}\right] &= \left[\begin{array}{c} \mathbf{0} \\ \boldsymbol{A}^{*} \boldsymbol{u}_{i} \end{array}\right] = \left[\begin{array}{l} \mathbf{0} \\ \mathbf{0} \end{array}\right] = 0\left[\begin{array}{c} \boldsymbol{u}_{i} \\ \mathbf{0} \end{array}\right], \quad i=r+1, \ldots, m, \\ \left[\begin{array}{cc} \mathbf{0} & \boldsymbol{A} \\ \boldsymbol{A}^{*} & \mathbf{0} \end{array}\right]\left[\begin{array}{c} \mathbf{0} \\ \boldsymbol{v}_{i} \end{array}\right] &= \left[\begin{array}{c} \boldsymbol{A} \boldsymbol{v}_{i} \\ \mathbf{0} \end{array}\right] = \left[\begin{array}{l} \mathbf{0} \\ \mathbf{0} \end{array}\right] = 0\left[\begin{array}{c} \mathbf{0} \\ \boldsymbol{v}_{i} \end{array}\right], \quad i=r+1, \ldots, n \end{aligned}$	$\begin{aligned} \begin{bmatrix} \mathbf{0} & \boldsymbol{A} \\ \boldsymbol{A}^{*} & \mathbf{0} \end{bmatrix}\begin{bmatrix} \boldsymbol{u}_i \\ \boldsymbol{v}_i \end{bmatrix} &= \begin{bmatrix} \boldsymbol{A}\boldsymbol{v}_i \\ \boldsymbol{A}^{*}\boldsymbol{u}_i \end{bmatrix} = \begin{bmatrix} \alpha_i\boldsymbol{u}_i \\ \alpha_i\boldsymbol{v}_i \end{bmatrix} = \alpha_i\begin{bmatrix} \boldsymbol{u}_i \\ \boldsymbol{v}_i \end{bmatrix}, \quad i=1,\ldots,r, \\ \begin{bmatrix} \mathbf{0} & \boldsymbol{A} \\ \boldsymbol{A}^{*} & \mathbf{0} \end{bmatrix}\begin{bmatrix} \boldsymbol{u}_i \\ -\boldsymbol{v}_i \end{bmatrix} &= \begin{bmatrix} -\boldsymbol{A}\boldsymbol{v}_i \\ \boldsymbol{A}^{*}\boldsymbol{u}_i \end{bmatrix} = \begin{bmatrix} -\alpha_i\boldsymbol{u}_i \\ \alpha_i\boldsymbol{v}_i \end{bmatrix} = -\alpha_i\begin{bmatrix} \boldsymbol{u}_i \\ -\boldsymbol{v}_i \end{bmatrix}, \quad i=1,\ldots,r, \\ \begin{bmatrix} \mathbf{0} & \boldsymbol{A} \\ \boldsymbol{A}^{*} & \mathbf{0} \end{bmatrix}\begin{bmatrix} \boldsymbol{u}_i \\ \mathbf{0} \end{bmatrix} &= \begin{bmatrix} \mathbf{0} \\ \boldsymbol{A}^{*}\boldsymbol{u}_i \end{bmatrix} = \begin{bmatrix} \mathbf{0} \\ \mathbf{0} \end{bmatrix} = 0\begin{bmatrix} \boldsymbol{u}_i \\ \mathbf{0} \end{bmatrix}, \quad i=r+1,\ldots,m, \\ \begin{bmatrix} \mathbf{0} & \boldsymbol{A} \\ \boldsymbol{A}^{*} & \mathbf{0} \end{bmatrix}\begin{bmatrix} \mathbf{0} \\ \boldsymbol{v}_i \end{bmatrix} &= \begin{bmatrix} \boldsymbol{A}\boldsymbol{v}_i \\ \mathbf{0} \end{bmatrix} = \begin{bmatrix} \mathbf{0} \\ \mathbf{0} \end{bmatrix} = 0\begin{bmatrix} \mathbf{0} \\ \boldsymbol{v}_i \end{bmatrix}, \quad i=r+1,\ldots,n. \end{aligned}$

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[refined: *basis*] beside an identifier: the LaTeX-source and Rendered cells both show a VERIFIED refinement, not MathPix's own reading — *basis* names what verified it (e.g. ink, source). The original reading is unchanged in the model but is not the one drawn here.

Identifier	Page	Conf.	LaTeX source	Rendered	Scan image
lyche-numerical-linear-algebra_EQ0630 (now)	229	—	`\begin{aligned} a_{11}x_{1} + a_{12}x_{2} + \cdots + a_{1n}x_{n} &= b_{1} \\ a_{21}x_{1} + a_{22}x_{2} + \cdots + a_{2n}x_{n} &= b_{2} \\ \vdots \qquad \vdots \qquad\qquad\vdots \qquad &\vdots \\ a_{m1}x_{1} + a_{m2}x_{2} + \cdots + a_{mn}x_{n} &= b_{m} \end{aligned}`	$\begin{aligned} a_{11}x_{1} + a_{12}x_{2} + \cdots + a_{1n}x_{n} &= b_{1} \\ a_{21}x_{1} + a_{22}x_{2} + \cdots + a_{2n}x_{n} &= b_{2} \\ \vdots \qquad \vdots \qquad\qquad\vdots \qquad &\vdots \\ a_{m1}x_{1} + a_{m2}x_{2} + \cdots + a_{mn}x_{n} &= b_{m} \end{aligned}$	$\begin{bmatrix} \mathbf{0} & \boldsymbol{A} \\ \boldsymbol{A}^* & \mathbf{0} \end{bmatrix} \begin{bmatrix} \boldsymbol{u}_i \\ \boldsymbol{v}_i \end{bmatrix} = \begin{bmatrix} \boldsymbol{A}\boldsymbol{v}_i \\ \boldsymbol{A}^*\boldsymbol{u}_i \end{bmatrix} = \begin{bmatrix} \alpha_i \boldsymbol{u}_i \\ \alpha_i \boldsymbol{v}_i \end{bmatrix} = \alpha_i \begin{bmatrix} \boldsymbol{u}_i \\ \boldsymbol{v}_i \end{bmatrix}, \quad i = 1, \ldots, r,$ $\begin{bmatrix} \mathbf{0} & \boldsymbol{A} \\ \boldsymbol{A}^* & \mathbf{0} \end{bmatrix} \begin{bmatrix} \boldsymbol{u}_i \\ -\boldsymbol{v}_i \end{bmatrix} = \begin{bmatrix} -\boldsymbol{A}\boldsymbol{v}_i \\ \boldsymbol{A}^*\boldsymbol{u}_i \end{bmatrix} = \begin{bmatrix} -\alpha_i \boldsymbol{u}_i \\ \alpha_i \boldsymbol{v}_i \end{bmatrix} = -\alpha_i \begin{bmatrix} \boldsymbol{u}_i \\ -\boldsymbol{v}_i \end{bmatrix}, \quad i = 1, \ldots, r,$ $\begin{bmatrix} \mathbf{0} & \boldsymbol{A} \\ \boldsymbol{A}^* & \mathbf{0} \end{bmatrix} \begin{bmatrix} \boldsymbol{u}_i \\ \mathbf{0} \end{bmatrix} = \begin{bmatrix} \mathbf{0} \\ \boldsymbol{A}^*\boldsymbol{u}_i \end{bmatrix} = \begin{bmatrix} \mathbf{0} \\ \mathbf{0} \end{bmatrix} = 0 \begin{bmatrix} \boldsymbol{u}_i \\ \mathbf{0} \end{bmatrix}, \quad i = r+1, \ldots, m,$ $\begin{bmatrix} \mathbf{0} & \boldsymbol{A} \\ \boldsymbol{A}^* & \mathbf{0} \end{bmatrix} \begin{bmatrix} \mathbf{0} \\ \boldsymbol{v}_i \end{bmatrix} = \begin{bmatrix} \boldsymbol{A}\boldsymbol{v}_i \\ \mathbf{0} \end{bmatrix} = \begin{bmatrix} \mathbf{0} \\ \mathbf{0} \end{bmatrix} = 0 \begin{bmatrix} \mathbf{0} \\ \boldsymbol{v}_i \end{bmatrix}, \quad i = r+1, \ldots, n.$
basis: inferred / ink					
lyche-numerical-linear-algebra_EQ0670 (was)	241	■ 0.390	`\begin{aligned} a_{i i} & =2 d, i=1, \ldots, n, \\ a_{i, i+1}=a_{i+1, i} & =a, \quad i=1, \ldots, n-1, \quad i \neq m, 2 m, \ldots,(m-1) m, \\ a_{i, i+m}=a_{i+m, i} & =a, \quad i=1, \ldots, n-m, \\ a_{i j} & =0, \text { otherwise } \end{aligned}`	$\begin{aligned} a_{i i} & =2 d, i=1, \ldots, n, \\ a_{i, i+1}=a_{i+1, i} & =a, \quad i=1, \ldots, n-1, \quad i \neq m, 2 m, \ldots,(m-1) m, \\ a_{i, i+m}=a_{i+m, i} & =a, \quad i=1, \ldots, n-m, \\ a_{i j} & =0, \text { otherwise } \end{aligned}$	$\begin{aligned} a_{ii} &= 2d,\ i = 1, \ldots, n, \\ a_{i,i+1} = a_{i+1,i} &= a, \quad i = 1, \ldots, n-1, \quad i \neq m, 2m, \ldots, (m-1)m, \\ a_{i,i+m} = a_{i+m,i} &= a, \quad i = 1, \ldots, n-m, \\ a_{ij} &= 0, \quad \text{otherwise,} \end{aligned}$
lyche-numerical-linear-algebra_EQ0670 (now)	241	—	`\begin{bmatrix} \vdots & \vdots & \cdots & \vdots \\ a_{r_2, c_1} & a_{r_2, c_1+1} & \cdots & a_{r_2, c_2} \end{bmatrix}`	$\begin{bmatrix} \vdots & \vdots & \cdots & \vdots \\ a_{r_2, c_1} & a_{r_2, c_1+1} & \cdots & a_{r_2, c_2} \end{bmatrix}$	$\begin{aligned} a_{ii} &= 2d,\ i = 1, \ldots, n, \\ a_{i,i+1} = a_{i+1,i} &= a, \quad i = 1, \ldots, n-1, \quad i \neq m, 2m, \ldots, (m-1)m, \\ a_{i,i+m} = a_{i+m,i} &= a, \quad i = 1, \ldots, n-m, \\ a_{ij} &= 0, \quad \text{otherwise,} \end{aligned}$
basis: inferred / ink					

Conf. MathPix confidence: ■ ≥0.9 ■ 0.5–0.9 ■ <0.5 — no value

LaTeX source MathPix's reading, unchanged; **Rendered** the same reading, with a display environment (align/alignat/flalign/eqnarray/gather/multline/split) mapped to its in-math form so it can typeset in this cell — the two may legitimately differ

Residual render vs scan (inkdrill): • C component • W weak • S stable • N noise • K clean • not measured

[refined: *basis*] beside an identifier: the LaTeX-source and Rendered cells both show a VERIFIED refinement, not MathPix's own reading — *basis* names what verified it (e.g. ink, source). The original reading is unchanged in the model but is not the one drawn here.

Identifier	Page	Conf.	LaTeX source	Rendered	Scan image
lyche-numerical-linear-algebra_EQ0706 (was)	253	■ 0.001	`\begin{array}{rl} \boldsymbol{T} \boldsymbol{V}+ \boldsymbol{V} \boldsymbol{T} & =h^{2} \boldsymbol{F} \\ \boldsymbol{V}^{\boldsymbol{V}=\boldsymbol{S} \boldsymbol{X} \boldsymbol{S}} \boldsymbol{T} \boldsymbol{S} \boldsymbol{X} \boldsymbol{S}+ \boldsymbol{S} \boldsymbol{X} \boldsymbol{S} \boldsymbol{T} & =h^{2} \boldsymbol{F} \\ \stackrel{ \boldsymbol{S}() \boldsymbol{S}}{\Longleftrightarrow} \boldsymbol{S} \boldsymbol{T} \boldsymbol{S} \boldsymbol{X} \boldsymbol{S}^{2}+\boldsymbol{S}^{2} \boldsymbol{X} \boldsymbol{S} \boldsymbol{T} \boldsymbol{S} & =h^{2} \boldsymbol{S} \boldsymbol{F} \boldsymbol{S}=h^{2} \boldsymbol{G} \\ \stackrel{ \boldsymbol{T}}{\Leftrightarrow} \boldsymbol{S}^{ \mathbf{2}} \boldsymbol{D} & \boldsymbol{S} \boldsymbol{X} \boldsymbol{S}^{2}+\boldsymbol{S}^{2} \boldsymbol{X} \boldsymbol{S}^{2} \boldsymbol{D} \\ \boldsymbol{S}^{2} & =h^{2} \boldsymbol{G} \\ \Longleftrightarrow & \boldsymbol{I} /(2 h) \end{array}`	$\begin{array}{rl} \boldsymbol{TV}+\boldsymbol{VT} & =h^{2}\boldsymbol{F} \\ \boldsymbol{V}^{\boldsymbol{V}=\boldsymbol{SXS}}\boldsymbol{TSXS}+\boldsymbol{SXST} & =h^{2}\boldsymbol{F} \\ \stackrel{\boldsymbol{S}()\boldsymbol{S}}{\Longleftrightarrow} \boldsymbol{STSXS}^{2}+\boldsymbol{S}^{2}\boldsymbol{XSTS} & =h^{2}\boldsymbol{SFS}=h^{2}\boldsymbol{G} \\ \stackrel{\boldsymbol{T}}{\Leftrightarrow} \boldsymbol{S}^{\mathbf{2}}\boldsymbol{D} & \boldsymbol{SXS}^{2}+\boldsymbol{S}^{2}\boldsymbol{XS}^{2}\boldsymbol{D} \\ \boldsymbol{S}^{2} & =h^{2}\boldsymbol{G} \\ \Longleftrightarrow & \boldsymbol{I}/(2h) \end{array}$	$\begin{array}{r} \boldsymbol{TV}+\boldsymbol{VT}=h^{2}\boldsymbol{F} \\ \stackrel{\boldsymbol{V}=\boldsymbol{SXS}}{\Longleftrightarrow} \boldsymbol{TSXS}+\boldsymbol{SXST}=h^{2}\boldsymbol{F} \\ \stackrel{\boldsymbol{S}()\boldsymbol{S}}{\Longleftrightarrow} \boldsymbol{STSXS}^{2}+\boldsymbol{S}^{2}\boldsymbol{XSTS}=h^{2}\boldsymbol{SFS}=h^{2}\boldsymbol{G} \\ \stackrel{\boldsymbol{TS}=\boldsymbol{SD}}{\Longleftrightarrow} \boldsymbol{S}^{2}\boldsymbol{DXS}^{2}+\boldsymbol{S}^{2}\boldsymbol{XS}^{2}\boldsymbol{D}=h^{2}\boldsymbol{G} \\ \stackrel{\boldsymbol{S}^{2}=\boldsymbol{I}/(2h)}{\Longleftrightarrow} \boldsymbol{DX}+\boldsymbol{XD}=4h^{4}\boldsymbol{G}. \end{array}$
lyche-numerical-linear-algebra_EQ0706 (now)	253	—	`\begin{array}{rl} \boldsymbol{TV}+\boldsymbol{VT} & = h^{2}\boldsymbol{F} \\ \stackrel{V=SXS}{ \Longleftrightarrow} \boldsymbol{TSXS}+\boldsymbol{SXST} & = h^{2}\boldsymbol{F} \\ \stackrel{S()S}{ \Longleftrightarrow} \boldsymbol{STSXS^{2}}+ \boldsymbol{S^{2}XSTS} & = h^{2}\boldsymbol{SFS}=h^{2} \boldsymbol{G} \\ \stackrel{TS=SD}{\Longleftrightarrow} \boldsymbol{S^{2}DXS^{2}}+\boldsymbol{S^{2}XS^{2}D} & = h^{2}\boldsymbol{G} \\ \stackrel{S^{2}=I/(2h)}{ \Longleftrightarrow} \boldsymbol{DX}+\boldsymbol{XD} & = 4h^{4}\boldsymbol{G}. \end{array}`	$\begin{array}{rl} \boldsymbol{TV}+\boldsymbol{VT} & = h^{2}\boldsymbol{F} \\ \stackrel{V=SXS}{\Longleftrightarrow} \boldsymbol{TSXS}+\boldsymbol{SXST} & = h^{2}\boldsymbol{F} \\ \stackrel{S()S}{\Longleftrightarrow} \boldsymbol{STSXS^{2}}+\boldsymbol{S^{2}XSTS} & = h^{2}\boldsymbol{SFS}=h^{2}\boldsymbol{G} \\ \stackrel{TS=SD}{\Longleftrightarrow} \boldsymbol{S^{2}DXS^{2}}+\boldsymbol{S^{2}XS^{2}D} & = h^{2}\boldsymbol{G} \\ \stackrel{S^{2}=I/(2h)}{\Longleftrightarrow} \boldsymbol{DX}+\boldsymbol{XD} & = 4h^{4}\boldsymbol{G}. \end{array}$	$\begin{array}{r} \boldsymbol{TV}+\boldsymbol{VT}=h^{2}\boldsymbol{F} \\ \stackrel{\boldsymbol{V}=\boldsymbol{SXS}}{\Longleftrightarrow} \boldsymbol{TSXS}+\boldsymbol{SXST}=h^{2}\boldsymbol{F} \\ \stackrel{\boldsymbol{S}()\boldsymbol{S}}{\Longleftrightarrow} \boldsymbol{STSXS}^{2}+\boldsymbol{S}^{2}\boldsymbol{XSTS}=h^{2}\boldsymbol{SFS}=h^{2}\boldsymbol{G} \\ \stackrel{\boldsymbol{TS}=\boldsymbol{SD}}{\Longleftrightarrow} \boldsymbol{S}^{2}\boldsymbol{DXS}^{2}+\boldsymbol{S}^{2}\boldsymbol{XS}^{2}\boldsymbol{D}=h^{2}\boldsymbol{G} \\ \stackrel{\boldsymbol{S}^{2}=\boldsymbol{I}/(2h)}{\Longleftrightarrow} \boldsymbol{DX}+\boldsymbol{XD}=4h^{4}\boldsymbol{G}. \end{array}$

basis: inferred / ink

Conf. MathPix confidence: ■ ≥0.9 ■ 0.5–0.9 ■ <0.5 — no value

LaTeX source MathPix's reading, unchanged; **Rendered** the same reading, with a display environment (align/alignat/flalign/eqnarray/gather/multline/split) mapped to its in-math form so it can typeset in this cell — the two may legitimately differ

Residual render vs scan (inkdrill): • C component • W weak • S stable • N noise • K clean • not measured

[refined: *basis*] beside an identifier: the LaTeX-source and Rendered cells both show a VERIFIED refinement, not MathPix's own reading — *basis* names what verified it (e.g. ink, source). The original reading is unchanged in the model but is not the one drawn here.

Identifier	Page	Conf.	LaTeX source	Rendered	Scan image
lyche-numerical-linear-algebra_ EQ0729 (was)	258	■ 0.002	`\begin{array}{lll} \left(\boldsymbol{F}_{2 m} \boldsymbol{P}_{2 m}\right)_{p, q} & =\omega_{2 m}^{j(2 k)} & =\omega_{m}^{j k}, \\ \left(\boldsymbol{F}_{2 m} \boldsymbol{P}_{2 m}\right)_{p+m, q} & =\omega_{2 m}^{(j+m)(2 k)} & =\omega_{m}^{j+m) k} \\ \left(\boldsymbol{F}_{2 m} \boldsymbol{P}_{2 m}\right)_{p, q+m} & =\omega_{2 m}^{j(2 k+1)} & =\omega_{2 m}^{j} \omega_{m}^{j k}, \\ \left(\boldsymbol{F}_{2 m} \boldsymbol{P}_{2 m}\right)_{p+m, q+m} & \left.=\omega_{2 m}^{j+m}\right)(2 k+1) & \left.=\omega_{2 m}^{j+m} \omega_{m}^{j+m}\right) k \\ & \\ (j+m & & \end{array}`	$\begin{array}{lll} (\boldsymbol{F}_{2m}\boldsymbol{P}_{2m})_{p,q} & =\omega_{2m}^{j(2k)} & =\omega_{m}^{jk}, \\ (\boldsymbol{F}_{2m}\boldsymbol{P}_{2m})_{p+m,q} & =\omega_{2m}^{(j+m)(2k)} & =\omega_{m}^{j+m)k} \\ (\boldsymbol{F}_{2m}\boldsymbol{P}_{2m})_{p,q+m} & =\omega_{2m}^{j(2k+1)} & =\omega_{2m}^{j}\omega_{m}^{jk}, \\ (\boldsymbol{F}_{2m}\boldsymbol{P}_{2m})_{p+m,q+m} & \left.=\omega_{2m}^{j+m}\right)(2k+1) & \left.=\omega_{2m}^{j+m}\omega_{m}^{j+m}\right)k \\ & \\ (j+m & & \end{array}$	$\begin{aligned} (\boldsymbol{F}_{2m}\boldsymbol{P}_{2m})_{p,q} &= \omega_{2m}^{j(2k)} = \omega_m^{jk}, \\ (\boldsymbol{F}_{2m}\boldsymbol{P}_{2m})_{p+m,q} &= \omega_{2m}^{(j+m)(2k)} = \omega_m^{(j+m)k} = \omega_m^{jk}, \\ (\boldsymbol{F}_{2m}\boldsymbol{P}_{2m})_{p,q+m} &= \omega_{2m}^{j(2k+1)} = \omega_{2m}^{j}\omega_m^{jk}, \\ (\boldsymbol{F}_{2m}\boldsymbol{P}_{2m})_{p+m,q+m} &= \omega_{2m}^{(j+m)(2k+1)} = \omega_{2m}^{j+m}\omega_m^{(j+m)k} = -\omega_{2m}^{j}\omega_m^{jk}. \end{aligned}$
lyche-numerical-linear-algebra_ EQ0729 (now)	258	—	`(DX + XD)_{j,k} = \sum_{\ell=1}^{m} d_{j,\ell} x_{\ell,k} + \sum_{\ell=1}^{m} x_{j,\ell} d_{\ell,k} = \lambda_j x_{j,k} + \lambda_k x_{j,k} \quad \text{for all } j, k`	$(DX + XD)_{j,k} = \sum_{\ell=1}^{m} d_{j,\ell} x_{\ell,k} + \sum_{\ell=1}^{m} x_{j,\ell} d_{\ell,k} = \lambda_j x_{j,k} + \lambda_k x_{j,k} \quad \text{for all } j, k$	$\begin{aligned} (\boldsymbol{F}_{2m}\boldsymbol{P}_{2m})_{p,q} &= \omega_{2m}^{j(2k)} = \omega_m^{jk}, \\ (\boldsymbol{F}_{2m}\boldsymbol{P}_{2m})_{p+m,q} &= \omega_{2m}^{(j+m)(2k)} = \omega_m^{(j+m)k} = \omega_m^{jk}, \\ (\boldsymbol{F}_{2m}\boldsymbol{P}_{2m})_{p,q+m} &= \omega_{2m}^{j(2k+1)} = \omega_{2m}^{j}\omega_m^{jk}, \\ (\boldsymbol{F}_{2m}\boldsymbol{P}_{2m})_{p+m,q+m} &= \omega_{2m}^{(j+m)(2k+1)} = \omega_{2m}^{j+m}\omega_m^{(j+m)k} = -\omega_{2m}^{j}\omega_m^{jk}. \end{aligned}$
basis: inferred / ink					
lyche-numerical-linear-algebra_ EQ0763 (was)	271	■ 0.402	`\boldsymbol{G}_{\omega}=\left[\begin{array}{ll} l & 0 \ \ 0 & 1 \end{array}\right]-\left[\begin{array}{cc} \omega / 2 & 0 \\ \omega^{2} / 4 & \omega / 2 \end{array}\right] \left[\begin{array}{cc} 2 & -1 \\ -1 & 2 \end{array} \right]=\left[\begin{array}{cc} 1-\omega & \omega / 2 \\ \omega(1-\omega) / 2 & 1-\omega+\omega^{2} / 4 \end{array}\right] .`	$\boldsymbol{G}_{\omega}=\left[\begin{array}{ll} l & 0 \\ 0 & 1 \end{array}\right]-\left[\begin{array}{cc} \omega / 2 & 0 \\ \omega^{2} / 4 & \omega / 2 \end{array}\right] \left[\begin{array}{cc} 2 & -1 \\ -1 & 2 \end{array} \right]=\left[\begin{array}{cc} 1-\omega & \omega / 2 \\ \omega(1-\omega) / 2 & 1-\omega+\omega^{2} / 4 \end{array}\right] .$	$\boldsymbol{G}_{\omega} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} - \begin{bmatrix} \omega/2 & 0 \\ \omega^2/4 & \omega/2 \end{bmatrix} \begin{bmatrix} 2 & -1 \\ -1 & 2 \end{bmatrix} = \begin{bmatrix} 1-\omega & \omega/2 \\ \omega(1-\omega)/2 & 1-\omega+\omega^2/4 \end{bmatrix}.$
lyche-numerical-linear-algebra_ EQ0763 (now)	271	—	`\langle j_1, j_2 \mid j_c \rangle \qquad \begin{bmatrix} \cdot & \cdot & \cdots & \cdot \\ a_{i_r, j_1} & a_{i_r, j_2} & \cdots & a_{i_r, j_c} \end{bmatrix}`	$\langle j_1, j_2 \mid j_c \rangle \qquad \begin{bmatrix} \cdot & \cdot & \cdots & \cdot \\ a_{i_r, j_1} & a_{i_r, j_2} & \cdots & a_{i_r, j_c} \end{bmatrix}$	$\boldsymbol{G}_{\omega} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} - \begin{bmatrix} \omega/2 & 0 \\ \omega^2/4 & \omega/2 \end{bmatrix} \begin{bmatrix} 2 & -1 \\ -1 & 2 \end{bmatrix} = \begin{bmatrix} 1-\omega & \omega/2 \\ \omega(1-\omega)/2 & 1-\omega+\omega^2/4 \end{bmatrix}.$
basis: inferred / ink					

Conf. MathPix confidence: ■ ≥0.9 ■ 0.5–0.9 ■ <0.5 — no value

LaTeX source MathPix's reading, unchanged; **Rendered** the same reading, with a display environment (align/alignat/flalign/eqnarray/gather/multline/split) mapped to its in-math form so it can typeset in this cell — the two may legitimately differ

Residual render vs scan (inkdrill): • C component • W weak • S stable • N noise • K clean • not measured

[refined: *basis*] beside an identifier: the LaTeX-source and Rendered cells both show a VERIFIED refinement, not MathPix's own reading — *basis* names what verified it (e.g. ink, source). The original reading is unchanged in the model but is not the one drawn here.

Unresolved

<table>
<tr><th>Identifier</th><th>Page</th><th>Conf.</th><th>LaTeX source</th><th>Rendered</th><th>Image</th></tr>
<tr><td>lyche-numerical-linear-algebra_ EQ1043</td><td>353</td><td>■ 0.971
● C|+78</td><td>\begin{figure} \[\boldsymbol{A}=\left[\begin{array}{llll} x & x & x & x \\ 0 & x & x & x \\ 0 & 0 & x & x \\ 0 & 0 & 0 & x \end{array} \right] \xrightarrow{\boldsymbol{P}_{12}^{*}}\left[\begin{array}{llll} x & x & x & x \\ \mathbf{x} & x & x & x \\ 0 & 0 & x & x \\ 0 & 0 & 0 & x \end{array} \right] \xrightarrow{\boldsymbol{P}_{23}^{*}}\left[\begin{array}{llll} x & x & x & x \\ x & x & x & x \\ 0 & \mathbf{x} & x & x \\ 0 & 0 & 0 & x \end{array} \right] \xrightarrow{\boldsymbol{P}_{34}^{*}}\left[\begin{array}{llll} x & x & x & x \\ x & x & x & x \\ 0 & x & x & x \\ 0 & 0 & \mathbf{x} & x \end{array}\right] . \] \captionsetup{labelformat=empty} \caption{Fig. 15.1 Post multiplication in a QR step} \end{figure}</td><td>(not rendered)</td><td>$\boldsymbol{A}=\left[\begin{array}{llll} x & x & x & x \\ 0 & x & x & x \\ 0 & 0 & x & x \\ 0 & 0 & 0 & x \end{array}\right] \xrightarrow{\boldsymbol{P}_{12}^{*}} \left[\begin{array}{llll} x & x & x & x \\ \mathbf{x} & x & x & x \\ 0 & 0 & x & x \\ 0 & 0 & 0 & x \end{array}\right] \xrightarrow{\boldsymbol{P}_{23}^{*}} \left[\begin{array}{llll} x & x & x & x \\ x & x & x & x \\ 0 & \mathbf{x} & x & x \\ 0 & 0 & 0 & x \end{array}\right] \xrightarrow{\boldsymbol{P}_{34}^{*}} \left[\begin{array}{llll} x & x & x & x \\ x & x & x & x \\ 0 & x & x & x \\ 0 & 0 & \mathbf{x} & x \end{array}\right].$</td></tr>
<tr><td>lyche-numerical-linear-algebra_ EQ0195 (3.9)</td><td>82</td><td>■ 1.000
● C|+10</td><td>\begin{figure} \captionsetup{labelformat=empty} \caption{Listing 3.3 cforwardsolve} \[N_{L U}:= \frac{2}{3} n^{3}-\frac{1}{2} n^{2}-\frac{1}{6} n \] \end{figure}</td><td>(not rendered)</td><td>$N_{LU} := \frac{2}{3}n^3 - \frac{1}{2}n^2 - \frac{1}{6}n$</td></tr>
<tr><td>lyche-numerical-linear-algebra_ EQ0232 (3.22)</td><td>93</td><td>■ 1.000
● C|+54</td><td>\begin{figure} \captionsetup{labelformat=empty} \caption{Listing 3.5 cbacksolve} \[\boldsymbol{A}((k+1): n,(k+1): n) \boldsymbol{b}_{k}((k+1): n)=- \boldsymbol{A}((k+1): n, k) b_{k}(k), \quad k=1, \ldots, n-1 . \] \end{figure}</td><td>(not rendered)</td><td>$\boldsymbol{A}((k+1):n,(k+1):n)\boldsymbol{b}_k((k+1):n) = -\boldsymbol{A}((k+1):n,k)b_k(k), \quad k=1,\ldots,n-1.$</td></tr>
<tr><td>lyche-numerical-linear-algebra_ EQ0258 (4.7)</td><td>106</td><td>■ 1.000
● C|+54</td><td>\begin{figure} \captionsetup{labelformat=empty} \caption{Listing 4.2 bandcholesky} \[0<(\leq)\left(\alpha \boldsymbol{e}_{i}+\beta \boldsymbol{e}_{j}\right)^{*} \boldsymbol{A}\left(\alpha \boldsymbol{e}_{i}+\beta \boldsymbol{e}_{j} \right)=|\alpha|^{2} a_{i i}+|\beta|^{2} a_{j j}+2 \operatorname{Re}\left(\bar{\alpha} \beta a_{i j}\right) . \] \end{figure}</td><td>(not rendered)</td><td>$0 < (\leq)(\alpha \boldsymbol{e}_i + \beta \boldsymbol{e}_j)^* \boldsymbol{A}(\alpha \boldsymbol{e}_i + \beta \boldsymbol{e}_j) = |\alpha|^2 a_{ii} + |\beta|^2 a_{jj} + 2\operatorname{Re}(\overline{\alpha}\beta a_{ij}).$</td></tr>
</table>

Conf. MathPix confidence: ■ ≥0.9 ■ 0.5–0.9 ■ <0.5 — no value

LaTeX source MathPix's reading, unchanged; **Rendered** the same reading, with a display environment (align/alignat/flalign/eqnarray/gather/multline/split) mapped to its in-math form so it can typeset in this cell — the two may legitimately differ

Residual render vs scan (inkdrill): ● C component ● W weak ● S stable ● N noise ● K clean ● not measured

[refined: *basis*] beside an identifier: the LaTeX-source and Rendered cells both show a VERIFIED refinement, not MathPix's own reading — *basis* names what verified it (e.g. ink, source). The original reading is unchanged in the model but is not the one drawn here.

Flagged, not acted on

<table>
<tr><th>Identifier</th><th>Page</th><th>Conf.</th><th>LaTeX source</th><th>Rendered</th><th>Image</th></tr>
<tr>
<td>lyche-numerical-linear-algebra_ EQ0855</td>
<td>296</td>
<td>■ 0.386
● C|-60</td>
<td><code>\begin{array}{ll} \boldsymbol{t}_{0}=\left[\begin{array}{c} 3 \\ -3 / 2 \end{array}\right], \quad \alpha_{0}=1 / 2, \quad \boldsymbol{x}_{1}=\left[\begin{array}{l} -1 / 4 \\ -1 / 2 \end{array}\right], \quad \boldsymbol{r}_{1}=\left[\begin{array}{c} 0 \\ 3 / 4 \end{array}\right], \quad \beta_{0}=1 / 4, \\ \boldsymbol{p}_{1}=\left[\begin{array}{l} 3 / 8 \\ 3 / 4 \end{array}\right], \quad \boldsymbol{t}_{1}=\left[\begin{array}{c} 0 \\ 9 / 8 \end{array}\right], \quad \alpha_{1}=2 / 3, \quad \boldsymbol{x}_{2}=\mathbf{0}, \quad \boldsymbol{r}_{2}=\mathbf{0} . \end{array}</code></td>
<td>$$\begin{array}{ll} \boldsymbol{t}_{0}=\left[\begin{array}{c} 3 \\ -3 / 2 \end{array}\right], \quad \alpha_{0}=1 / 2, \quad \boldsymbol{x}_{1}=\left[\begin{array}{l} -1 / 4 \\ -1 / 2 \end{array}\right], \quad \boldsymbol{r}_{1}=\left[\begin{array}{c} 0 \\ 3 / 4 \end{array}\right], \quad \beta_{0}=1 / 4, \\ \boldsymbol{p}_{1}=\left[\begin{array}{l} 3 / 8 \\ 3 / 4 \end{array}\right], \quad \boldsymbol{t}_{1}=\left[\begin{array}{c} 0 \\ 9 / 8 \end{array}\right], \quad \alpha_{1}=2 / 3, \quad \boldsymbol{x}_{2}=\mathbf{0}, \quad \boldsymbol{r}_{2}=\mathbf{0} . \end{array}$$</td>
<td>$$\begin{array}{l} \boldsymbol{t}_0=\left[\begin{smallmatrix} 3 \\ -3/2 \end{smallmatrix}\right], \quad \alpha_0=1/2, \quad \boldsymbol{x}_1=\left[\begin{smallmatrix} -1/4 \\ -1/2 \end{smallmatrix}\right], \quad \boldsymbol{r}_1=\left[\begin{smallmatrix} 0 \\ 3/4 \end{smallmatrix}\right], \quad \beta_0=1/4, \\ \boldsymbol{p}_1=\left[\begin{smallmatrix} 3/8 \\ 3/4 \end{smallmatrix}\right], \quad \boldsymbol{t}_1=\left[\begin{smallmatrix} 0 \\ 9/8 \end{smallmatrix}\right], \quad \alpha_1=2/3, \quad \boldsymbol{x}_2=\mathbf{0}, \quad \boldsymbol{r}_2=\mathbf{0}. \end{array}$$</td>
</tr>
<tr>
<td>lyche-numerical-linear-algebra_ EQ0485</td>
<td>191</td>
<td>■ 0.917
● C|+32</td>
<td><code>\begin{aligned} & \|\boldsymbol{A} \boldsymbol{B}\|=\max _{\boldsymbol{x} \neq \mathbf{0}} \frac{\|\boldsymbol{A} \boldsymbol{B} \boldsymbol{x}\|}{\|\boldsymbol{x}\|}= \max _{\boldsymbol{B} \boldsymbol{x} \neq \mathbf{0}} \frac{\|\boldsymbol{A} \boldsymbol{B} \boldsymbol{x}\|}{ \|\boldsymbol{x}\|}=\max _{\boldsymbol{B} \boldsymbol{x} \neq \mathbf{0}} \frac{\|\boldsymbol{A} \boldsymbol{B} \boldsymbol{x}\|}{\|\boldsymbol{B} \boldsymbol{x}\|} \frac{\|\boldsymbol{B} \boldsymbol{x}\|}{\|\boldsymbol{x} \|} \\ & \quad \leq \max _{\boldsymbol{y} \neq \mathbf{0}} \frac{\|\boldsymbol{A} \boldsymbol{y}\|}{\| \boldsymbol{y}\|} \max _{\boldsymbol{x} \neq \mathbf{0}} \frac{\|\boldsymbol{B} \boldsymbol{x}\|}{\|\boldsymbol{x} \|}=\|\boldsymbol{A}\|\|\boldsymbol{B}\| \end{aligned}</code></td>
<td>$$\begin{aligned} & \|\boldsymbol{A} \boldsymbol{B}\|=\max _{\boldsymbol{x} \neq \mathbf{0}} \frac{\|\boldsymbol{A} \boldsymbol{B} \boldsymbol{x}\|}{\|\boldsymbol{x}\|}= \max _{\boldsymbol{B} \boldsymbol{x} \neq \mathbf{0}} \frac{\|\boldsymbol{A} \boldsymbol{B} \boldsymbol{x}\|}{ \|\boldsymbol{x}\|}=\max _{\boldsymbol{B} \boldsymbol{x} \neq \mathbf{0}} \frac{\|\boldsymbol{A} \boldsymbol{B} \boldsymbol{x}\|}{\|\boldsymbol{B} \boldsymbol{x}\|} \frac{\|\boldsymbol{B} \boldsymbol{x}\|}{\|\boldsymbol{x} \|} \\ & \quad \leq \max _{\boldsymbol{y} \neq \mathbf{0}} \frac{\|\boldsymbol{A} \boldsymbol{y}\|}{\| \boldsymbol{y}\|} \max _{\boldsymbol{x} \neq \mathbf{0}} \frac{\|\boldsymbol{B} \boldsymbol{x}\|}{\|\boldsymbol{x} \|}=\|\boldsymbol{A}\|\|\boldsymbol{B}\| \end{aligned}$$</td>
<td>$$\begin{aligned} \|\boldsymbol{A}\boldsymbol{B}\| &= \max_{\boldsymbol{x}\neq\mathbf{0}} \tfrac{\|\boldsymbol{A}\boldsymbol{B}\boldsymbol{x}\|}{\|\boldsymbol{x}\|} = \max_{\boldsymbol{B}\boldsymbol{x}\neq\mathbf{0}} \tfrac{\|\boldsymbol{A}\boldsymbol{B}\boldsymbol{x}\|}{\|\boldsymbol{x}\|} = \max_{\boldsymbol{B}\boldsymbol{x}\neq\mathbf{0}} \tfrac{\|\boldsymbol{A}\boldsymbol{B}\boldsymbol{x}\|}{\|\boldsymbol{B}\boldsymbol{x}\|} \tfrac{\|\boldsymbol{B}\boldsymbol{x}\|}{\|\boldsymbol{x}\|} \\ &\leq \max_{\boldsymbol{y}\neq\mathbf{0}} \tfrac{\|\boldsymbol{A}\boldsymbol{y}\|}{\|\boldsymbol{y}\|} \max_{\boldsymbol{x}\neq\mathbf{0}} \tfrac{\|\boldsymbol{B}\boldsymbol{x}\|}{\|\boldsymbol{x}\|} = \|\boldsymbol{A}\|\,\|\boldsymbol{B}\|. \end{aligned}$$</td>
</tr>
<tr><td colspan="6">Conf. MathPix confidence: ■ ≥0.9 ■ 0.5–0.9 ■ <0.5 — no value
LaTeX source MathPix's reading, unchanged; Rendered the same reading, with a display environment (align/alignat/flalign/eqnarray/gather/multline/split) mapped to its in-math form so it can typeset in this cell — the two may legitimately differ
Residual render vs scan (inkdrill): ● C component ● W weak ● S stable ● N noise ● K clean ● not measured
[refined: basis] beside an identifier: the LaTeX-source and Rendered cells both show a VERIFIED refinement, not MathPix's own reading — basis names what verified it (e.g. ink, source). The original reading is unchanged in the model but is not the one drawn here.</td></tr>
</table>

194 more flagged rows below the band, stated as a count: 30 component, 164 weak; confidence high 138, mid 35, low 21, none 0