Advanced numerical methods / 고급 수치 해석

한글 설명과 mathematical notation in one report. These methods combine probability, matrix analysis and variational calculus.

Methods: normalized models, matrix identities and differential equations. Method reference.

A01. Normalized Gaussian mixture with nested exponent and radical

가정과 해석: the expression below keeps each numerator, denominator, matrix cell and script editable. *Check the grouped arguments.*

$$p\left(x\right)=\sum_{k=1}^{K}\frac{\pi_k e^{-\frac{\left(x-\mu_k\right)^2}{2\sigma_k^2}}}{\sqrt{2\pi\sigma_k^2}}$$

3. 분자·분모와 첨자의 역할을 확인합니다.

4. Compare the expression with the original text input.

검토 기록 / Review record	
Assumptions	**Finite dimensions** and positive parameters.
	Nested note: *Preserve the original cell order.*

Reference swatch and a caption.

A02. Full 3 by 3 Hessian with mixed partial derivatives

가정과 해석: the expression below keeps each numerator, denominator, matrix cell and script editable. *Check the grouped arguments.*

$$H=\begin{bmatrix}\frac{\partial^2 f}{\partial x^2} & \frac{\partial^2 f}{\partial x\,\partial y} & \frac{\partial^2 f}{\partial x\,\partial z}\\ \frac{\partial^2 f}{\partial y\,\partial x} & \frac{\partial^2 f}{\partial y^2} & \frac{\partial^2 f}{\partial y\,\partial z}\\ \frac{\partial^2 f}{\partial z\,\partial x} & \frac{\partial^2 f}{\partial z\,\partial y} & \frac{\partial^2 f}{\partial z^2}\end{bmatrix}$$

3. 분자·분모와 첨자의 역할을 확인합니다.

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A03. Nested block matrix and Schur complement

가정과 해석: the expression below keeps each numerator, denominator, matrix cell and script editable. *Check the grouped arguments.*

$$M=\begin{bmatrix} \begin{bmatrix} a & b \\ c & d \end{bmatrix} & \begin{bmatrix} 1 \\ \lambda \end{bmatrix} \\ \begin{bmatrix} \mu & 0 \end{bmatrix} & \frac{1}{\delta+\sqrt{1+\lambda^{2}}} \end{bmatrix};\ S=D-C\,A^{-1}B$$

3. 분자·분모와 첨자의 역할을 확인합니다.

4. Compare the expression with the original text input.

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Reference swatch and a caption.

Section review complete.

A04. Three-branch robust loss with radicals and a rational transition

가정과 해석: the expression below keeps each numerator, denominator, matrix cell and script editable. *Check the grouped arguments.*

$$\rho_{\delta}(x)=\begin{cases}\dfrac{x^{2}}{2} & |x|\le\delta\\ \delta\left(\sqrt{x^{2}}-\dfrac{\delta}{2}\right) & \delta<|x|\le 2\,\delta\\ \dfrac{2\,\delta\,x^{2}}{\delta+\sqrt{x^{2}+\delta^{2}}} & |x|>2\,\delta\end{cases}$$

3. 분자·분모와 첨자의 역할을 확인합니다.

4. Compare the expression with the original text input.

A05. Fourier-Galerkin integral with an embedded infinite sum

가정과 해석: the expression below keeps each numerator, denominator, matrix cell and script editable. *Check the grouped arguments.*

$$\widehat{u}(\omega)=\frac{1}{\sqrt{2\,\pi}}\int_{-\infty}^{\infty}\left(\sum_{n=0}^{\infty}\frac{a_{n}\,x^{n}}{n\,!}\right)e^{-i\,\omega\,x}\,d\,x$$

3. 분자·분모와 첨자의 역할을 확인합니다.

4. Compare the expression with the original text input.

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	Nested note | *Preserve the original cell order.*

Reference swatch and a caption.

A06. Six-level continued fraction with indexed radicals

가정과 해석: the expression below keeps each numerator, denominator, matrix cell and script editable. *Check the grouped arguments.*

$$F = \cfrac{1}{x + \cfrac{1}{\sqrt{1+x^2} + \cfrac{2}{x + \cfrac{3}{\sqrt[3]{1+x} + \cfrac{4}{x + \cfrac{5}{1+x^2}}}}}}$$

3. 분자·분모와 첨자의 역할을 확인합니다.

4. Compare the expression with the original text input.

Section review complete.

A07. Euler-Lagrange derivative with a normalized gradient

가정과 해석: the expression below keeps each numerator, denominator, matrix cell and script editable. *Check the grouped arguments.*

$$\frac{\partial L}{\partial u} - \sum_{j=1}^{d} \frac{\partial}{\partial x_{j}} \left[\frac{\partial u / \partial x_{j}}{\sqrt{\varepsilon + \sum_{k=1}^{d} \left(\frac{\partial u}{\partial x_{k}} \right)^{2}}} \right] = 0$$

3. 분자·분모와 첨자의 역할을 확인합니다.

4. Compare the expression with the original text input.

검토 기록 / **Review record**	
Assumptions	**Finite dimensions** and positive parameters.
	Nested note: *Preserve the original cell order.*

Reference swatch and a caption.

A08. Tensor contraction with two sums and indexed rational factors

가정과 해석: the expression below keeps each numerator, denominator, matrix cell and script editable. *Check the grouped arguments.*

$$T_{k\,l}^{i\,j} = \sum_{m=1}^{N} \sum_{n=1}^{N} \frac{A_{m}^{i} B_{n}^{j} C_{k\,l}^{m\,n}}{1 + \sqrt{\lambda_{m} \lambda_{n}}}$$

3. 분자·분모와 첨자의 역할을 확인합니다.

4. Compare the expression with the original text input.

A09. Determinant of a regularized rational 3 by 3 matrix

가정과 해석: the expression below keeps each numerator, denominator, matrix cell and script editable. *Check the grouped arguments.*

$$D = \begin{vmatrix} \lambda + \dfrac{1}{1+x^2} & \dfrac{x}{\sqrt{1+y^2}} & 0 \\ \dfrac{x}{\sqrt{1+y^2}} & \lambda + \sqrt{1+y^2} & \dfrac{1}{1+z} \\ 0 & \dfrac{1}{1+z} & \lambda + z^2 \end{vmatrix}$$

3. 분자·분모와 첨자의 역할을 확인합니다.

4. Compare the expression with the original text input.

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Reference swatch and a caption.

Section review complete.

A10. Generalized quadratic quotient with matrix and transpose

가정과 해석: the expression below keeps each numerator, denominator, matrix cell and script editable. *Check the grouped arguments.*

$$R = \frac{\begin{pmatrix} x_1 , x_2 \end{pmatrix} \begin{bmatrix} a & \frac{b}{1+c^2} \\ \frac{b}{1+c^2} & d \end{bmatrix} \begin{pmatrix} x_1 , x_2 \end{pmatrix}^T}{\sqrt{\left(x_1^2 + x_2^2\right)\left(1+\delta^2\right)}}$$

3. 분자·분모와 첨자의 역할을 확인합니다.

4. Compare the expression with the original text input.