

Notes on Notation

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I. CONVENTIONS & SYMBOLS

Tables I-VI summarize the notational conventions that are used throughout this text. A non-bold face symbol denotes a scalar quantity. A bold face symbol denotes either a vector (typically lower case) or a matrix (typically upper case). It is important to make the distinction between a *true* value, a *calculated*, *estimated*, or a *measured* value. As shown in Table I, the true value has no additional mark; the calculated value has a “hat” on it; the measured value has a “tilde” above it. The error is defined as the true value minus the estimated value. The error quantity is indicated with a δ , for example $\delta x = x - \hat{x}$.

TABLE I
NOTATIONAL CONVENTIONS.

x	non-bold face variables denote <i>scalars</i>
\mathbf{x}	boldface lower-case denotes <i>vector</i> quantities
\mathbf{X}	boldface upper-case denotes <i>matrix</i> quantities
$x_{i,j}$	row i and column j entry of matrix \mathbf{X}
\mathbf{x}	true value of \mathbf{x}
$\hat{\mathbf{x}}$	calculated value of \mathbf{x}
$\tilde{\mathbf{x}}$	measured value of \mathbf{x}
$\delta \mathbf{x}$	error $\mathbf{x} - \hat{\mathbf{x}}$
\mathbf{R}_a^b	transformation matrix from reference frames a to b
\mathbf{x}_a	vector \mathbf{x} represented with respect to frame a
$\mathbb{R}, \mathbb{R}^+, \mathbb{R}^n$	real numbers, reals greater than 0, n -tuples of reals
\mathbb{N}	natural numbers $\{0, 1, 2, \dots\}$
\mathbb{C}	complex numbers
\mathbb{Z}	integer numbers
$\mathbf{0}_{n \times m}$ or $\mathbf{0}$	zero matrix
$\mathbf{I}_{n \times n}$ or \mathbf{I}	identity matrix
$ \mathbf{X} $	determinant of matrix \mathbf{X}
R, N	range space, null space
R_∞, N_∞	generalized range space and null space
\mathcal{N}	Normal or Gaussian random variable
\mathcal{L}	Laplace random variable
■	end of proof, “I have proved”

TABLE II
EQUIVALENCE SYMBOLS.

$=$	equal to
\neq	not equal to
$>$	greater than
$<$	less than
\geq	greater than or equal to
\leq	less than or equal to
\propto	proportional to
\approx	approximately equal to
\sim	distributed as (or indifference)
\equiv	equivalent to
\triangleq	computed as
\succsim	preferred to

TABLE III
SET NOTATION SYMBOLS.

$(a \dots b), [a \dots b]$	open interval, closed interval
$\langle \dots \rangle$	sequence (a list in which order matters)
$\{ \dots \}$	set (a list in which order does not matter)
\in	is an element of
\emptyset	empty set
\cup	union
\cap	intersection
\subset	subset

TABLE IV
LOGICAL SYMBOLS.

\therefore	therefore
\forall	for all
\exists	there exists
\implies	logical “then” statement
\iff	if and only if

TABLE V
ABBREVIATIONS.

<i>iff</i>	if an only if
s.t.	such that
LHS	left hand side
RHS	right hand side
QED	end of proof, “I have proved”
w.r.t.	with respect to

TABLE VI
GREEK LETTERS WITH PRONUNCIATION.

α	alpha <i>AL-fuh</i>
β	beta <i>BAY-tuh</i>
γ, Γ	gamma <i>GAM-muh</i>
δ, Δ	delta <i>DEL-tuh</i>
ϵ	epsilon <i>EP-suh-lon</i>
ζ	zeta <i>ZAY-tuh</i>
η	eta <i>AY-tuh</i>
θ, Θ	theta <i>THAY-tuh</i>
ι	iota <i>eye-OH-tuh</i>
κ	kappa <i>KAP-uh</i>
λ, Λ	lambda <i>LAM-duh</i>
μ	mu <i>MEW</i>
ν	nu <i>NEW</i>
ξ, Ξ	xi <i>KSIGH</i>
\omicron	omicron <i>OM-uh-CRON</i>
π, Π	pi <i>PIE</i>
ρ	rho <i>ROW</i>
σ, Σ	sigma <i>SIG-muh</i>
τ	tau <i>TOW (as in cow)</i>
υ, Υ	upsilon <i>OOP-suh-LON</i>
ϕ, Φ	phi <i>FEE, or FI (as in hi)</i>
χ	chi <i>KI (as in hi)</i>
ψ, Ψ	psi <i>SIGH, or PSIGH</i>
ω, Ω	omega <i>oh-MAY-guh</i>