ITTC 표준 기호(1)

(ITTC Standard Symbols)

수조시험연구회(KTTC)

국제수조회의(International Towing Tank Conference)는 오래전부터 기호 및 용어위원회(Symbols & Terminology Group)를 구성하여 표준기호를 제정해 왔다.

19차 ITTC('90.9. 스페인)에서 채택된 표준기호는 3가지 주제－General Mechanics, Ships in General, Special Craft－로 분류되어 있다. 이러한 표준기호를 나누어 소개하고자 한다(참고문헌 : "Standard Symbols and Terminology" 19th ITTC, Sept. 1990, Madrid, Spain).

SECTION 1 GENERAL MECHANICS

1.1 FUNDAMENTAL CONCEPTS

1.1.1 Concepts in General

Standard Symbol	Computer Symbol	Name of Concept	Definition or Explanation	SI Unit
a	ACC	Linear acceleration	Translatory acceleration dv/dt	m/s^2
A	A	Area in general		m^2
A_r	AT	Cross-sectional area of an experiment tank or tunnel		m^2
B	B	Breadth		m
C	FF(2)	Cross force	Force normal to lift and drag	N
D	FF(1)	Drag(force)	Force opposing translatory velocity, generally for a completely immersed body	N
d, D	D	Diameter in general		m
E	E	Energy in general		J
e	ED	Energy density	e/dV	Pa

Standard Symbol	Computer Symbol	Name of Concept	Definition or Explanation	SI Unit
f	FC	Friction coefficient	Ratio of tangential force to normal force between two sliding bodies or planes	1
f	FD	Force density	dF/dV	N/m^3
f	FR	Frequency	1/T	Hz
F	F	Force		N
g	G	Acceleration due to gravity	Specific gravity force, dW/dm	m/s^2
h	DE	Depth in general		m
L	L	Length		m
L	FF(3)	Lift(force)	Force perpendicular to translatory velocity	N
m	MA	Mass		kg
M	M	Moment of forces	First perpendicular to force distribution	Nm
n	N	Frequency or rate of revolution		Hz
O	O	Origin of body axes		1
P	P	Power		W
r, R	RD	Radius		m
R	R	Resistance(force)	Force opposing translatory velocity	N
R_c	RDC	Radius of curvature		m
s	SP	Length along path		m
t	TI	Time		s
t	TEM	Temperature		k
T	TC	Period	Duration of a cycle in a repeating (periodic) process	s
U	U	Velocity of a fluid		m/s
v, V	V	Linear velocity	Translatory velocity ds/dt	m/s
V	VOL	Volume		m^3
w	WD	Weight density	dw/dv(Formerly specific weight)	N/m^3
W	WT	Weight(force)	Gravity force	N
γ	SPECG	Relative mass or weight	Formerly specific gravity. Mass density of a substance divided by mass density of distilled water at 4℃.	1
η	ETA	Efficiency in general	Ratio of powers	
ρ	RHO	Mass density	dm/dv	kg/m^3
τ	TAU	Tangential stress		Pa
λ	SCALE	Scale ratio	Ship dimension divided by corresponding model dimension	1

Standard Symbol	Computer Symbol	Name of Concept	Definition or Explanation	SI Unit
σ	SIGS	Normal stress		Pa
ω	OMGF	Circular frequency	$2\pi f$	1/s
ω	OMGN	Angular velocity	$2\pi n$	1/s

1.1.2 Space Related Concepts

Standard Symbol	Computer Symbol	Name of Concept	Definition or Explanation	SI Unit
S	SM(I, J)	Any scalar quantity distributed in space	$\int ds$	
S_{ij}^{MO}	SMO(I, J)	Zero-th order moment of a scalar quantity	$\int \delta_{ij}\, ds = \delta_{ij}\, S$	
s_{ij}^{M1}	SM1(I, J)	First order moments of a scalar quantity	$\int \epsilon_{ikj}\, X_k\, ds$ Formerly static moments of inertia of a scalar distribution	
s_{ij}^{M2}	SM2(I, J)	Second order moments of a scalar quantity	$\int \epsilon_{kpi} X_i\, \epsilon_{kmj}\, X_m\, ds$ Formerly moments of inertia of a scalar distribution	
v_i^{M1}	VM1(I)	First order moments of a vector distribution	First order moments $\int \epsilon_{ijk}\, X_j\, dv_k$	
T_{ij}	T(I, J)	(Componensts of) a tensor in space referred to an orthogonal referred to an orthogonal system of Cartesian coordinates fixed in the body	$T_{ij}^s + T_{ij}^s$	
T_{ij}^a	TA(I, J)	Anti-symmetric part of a tensor	$\frac{(T_{ij} - T_x)}{2} = -T_x^a$	
T_{ij}^s	TS(I, J)	Symmetric part of a tensor	$\frac{(T_{ij} + T_x)}{2} = T_x^3$	
T_{ij}^T	TT(I, J)	Transposed tensor	T_X	
$T_{ij}v_j$	TPTV	Tensor product	$\sum_{j=1}^{\cdots} T_{ij}v_j$	
u_i, v_i	V(I)	Any vector quantities distributed in space		
u_i, v_i	SPUV	Scalar product	$\sum_{i=1}^{3} u_i v_i$	
$u_i v_j$	DPUV(I, J)	Diadic product	$u_i v_j$	

Standard Symbol	Computer Symbol	Name of Concept	Definition or Explanation	SI Unit
uv	UPUV(I)	Vector product	$\epsilon_{ijk} u_j v_k$	
v_i	V(I)	Components of a vector quantity distributed in space, referred to an orthogonal system of Cartesian coordinates fixed in the body	Zero-th order moments $\int dv_i$	
x, x_1	X, X(1)	Body axes and corresponding Cartesian coordinates	Right-hand orthogonal system of coordinates fixed in the body. The x-axis is forward and parallel to the reference or base line used to describe the body's shape. For dynamic considerations the origin is preferrably at the center of mass of the body and the z-axis vertically downward. The y-axis is then to starboard	m
y, x_2	Y, X(2)			
z, x_3	Z, X(3)			
x_0, x_{01}	X0, X0(1)	Space axes and corresponding Cartesian coordinates	Right-hand orthogonal system of coordinates fixed in relation to the earth, the positive z_0-axis is vertically downwards and the x_0-axis lies in the direction of initial motion	m
y_0, x_{02}	Y0, X0(2)			
z_0, x_{03}	Z0, X0(3)			
ϵ_{ijk}	$EPS_{(I, J, K)}$	Epsilon operator	+1 : ijk = 123,231,312 −1 : ijk = 321,231,132 0 : if otherwise	
δ_{ij}	DEL(I, J)	Delta operator unit tensor	+1 : ij = 11,22,33 0 : if otherwise	

1.1.3 Time Related Concepts

Standard Symbol	Computer Symbol	Name of Concept	Definition or Explanation	SI Unit
C	C	Any complex quantity	$C^R + iC^I = a + ib =$ $= C^A \exp(iC^R) =$ $= C^A \exp(iC^I) =$ $= r \exp(i\phi)$	
C^A, r	CA	Amplitude of a complex quantity	$\mathrm{mod}(C) =$ $= (C^{R_2} + C^{I_2})^{\frac{1}{2}} = \sqrt{a^2 + b^2}$	

Standard Symbol	Computer Symbol	Name of Concept	Definition or Explanation	SI Unit
C^C	CC	Cosine component of a complex quantity	C^R	
C^I, b	CI	Imaginary component of a complex quantity	$Im(c)=C^A\sin(c^P)$	
C^L	CL	(Phase) lag of a complex quantity	$-C^P$	
C^P, ϕ	CP	Phase(lead) of a complex quantity	$arc(C)=arctg(\frac{C^I}{C^R})$ $arc(\phi)=arctg(\frac{b}{a})$	
C^R, a	CR	Real component of a complex quantity	$Re(C)=C^A\cos(C^P)$	
C^S	CS	Sine component of a complex quantity	C^I	
C^J	CJ	Conjugate of a complex quantity	$C^R-iC^I=$ $=C^A\exp(-iC^P)$	
X_j^{SA}, r_{xj}	XSA(J)	Amplitude of spectral lines of a periodic function	$2\mathrm{mod}(X_j^F)$ $j\geq 1$ $r_{x0}=\mathrm{mod}(x_0^F)=a_{x0}$	
X_j^{sc}, a_{xj}	XSC(J)	Cosine Fourier coefficient	$2Re(X_j)=$ $\frac{2}{T}\int_0^T x(t)\cos(\omega_j t)dt$ $j\geq 1$ $a_{x0}=Re(x_j^F)=$ $=\frac{1}{T}\int_0^T x(t)dt$	
X_j^{sp}, ϕ_{xj}	XSP(J)	Phase(lead) of spectral line of a periodic function	$arc(x_j)=-arctg(\frac{C^S}{C^C})$	
X_j^{ss}, b_{xj}	XSS(J)	Sine Fourier coefficient	$-2Im(x^F)$ $=\frac{2}{T}\int_0^T x(t)\sin(\omega_j t)dt$ $j\geq 1\ b_{x0}=0$	
F_s		Fourier series operator	$x(t)=\sum_{F=-\infty}^{\infty} x_j^F\exp(i\omega_j t)$ $\omega_j=j\omega_i$ if xR, then : $x(t)=$ $\sum_{j=0}^{\infty} r_{xj}\cos(\omega_j t+\phi_{xj})=$ $\sum_{j=0}^{\infty} a_{xj}\cos(\omega_j t)+\sum_{j=0}^{\infty} b_{xj}\sin(\omega_j t)$	

Standard Symbol	Computer Symbol	Name of Concept	Definition or Explanation	SI Unit
F_T		Fourier transform operator	$X^F(\omega)=\int_{-\infty}^{\infty} x(t)\cdot \exp(-j\omega t)dt$	
F_T^{-1}		Inverse Fourier transform operator	$x(t)=$ $=\frac{1}{2\pi}\int_{-\infty}^{\infty}x^F(\omega)\cdot \cdot\exp(i\omega t)dt$	
$(yx)^R$, h_x	YXR	Impulse response function of a linear system with input x and output y	$F_j(h_{xy}{}^F)$	
$(yx)^F$, h_{yF}	YXF	Frequency response or transfer function of a linear with input y and output x	$F_T(h_{xy})$ if $h_{xy}=0$ for $t\leq 0$ $H_{xy}{}^R=H_T(H_{xy})$	
H_T	HT	Hilbert transform operator	$X^H=\frac{1}{\pi}\int_{-\infty}^{\infty}\frac{\chi(\tau)}{t-\tau}d\tau$	
X^S, S_X	XS	Spectrum or spectral density function of a real function	$\frac{2X}{2\pi}$, $\omega\geq 0$	
X^{SA}, $S_X{}^A$	XSA	Amplitude spectrum	$\mathrm{mod}(X^S)$	
X^{SC}, $S_X{}^C$	XSC	Cosine or co−spectrum	$\frac{1}{\pi}\int_{-\infty}^{\infty}x(t)\cos(\omega t)dt$	
X^{SI}, $S_X{}^I$	XSI	Imaginary spectrum	$\mathrm{Im}(X^S)$	
X^{SL}, $S_X{}^L$	XSL	(Phase) lag spectrum	$-\mathrm{arc}(X^S)$	
X^{SP}, $S_X{}^P$	XSP	Phase(lead) spectrum	$\mathrm{arc}(X^S)$	
$X_X{}^{SR}$		Real spectrum	$\mathrm{Re}(X^S)$	
$X_X{}^{SS}$		Sine or quadrative spectrum	$\frac{1}{\pi}\int_{-\infty}^{\infty}x(t)\sin(\omega t)$	
T	TC	Time period	Duration of a cycle	S
x, y		Real functions, typically of time	$x(t+kT)=x(t)$ k integer $-\infty\leq k\leq +\infty$	
x		Periodic or repeating function		
x^H	XH	Hilbert transform of a real function	$H_T(x)$	
X, X^F	XF	Fourier transform of a function	$F_T(X)$ if x real, then : $F_T(-\omega)=F_T{}^*(\omega)$	
X_j, X_j^F	XF(J)	Complex Fourier coefficient of a periodic function	$\frac{1}{T}\int_0^T x(t)\exp(-i\omega_j t)dt$ if x real, then : $X_{-j}=X_j^*$	

Standard Symbol	Computer Symbol	Name of Concept	Definition or Explanation	SI Unit
X^A	XA	Analytic function	$x+ix^A$	
$X_X{}^A$	XAF	Fourier transform of an a analytic function	2F $\omega \geq 0$	
$X_X{}^{AA}$	XAA	Instantaneous amplitude	$\mathrm{mod}(X^F)$	
$X_X{}^{AP}$	XAP	Instantaneous phase	$\mathrm{arc}(X^A)$	
ω_1	OMG1	Basic frequency	$\frac{2\pi}{T}$	
ω_i	OMAFX	Instantaneous circular frequency	$\frac{dx^{AP}}{dt}$	

Super script	Prefix	Meanings	Super script	Prefix	Meanings
		Functions, operators			Functions, operators
I	I	Imaginary	A	A	Amplitude
	IR	Impulse response	C	C	Cosine
L	L	(Phase) lag		FR	Frequency response
	S	Spectrum		F	Fourier series
P	P	Phase(lead)		F	Fourier transform
R	R	Real		H	Hilbert transform
S	S	Sine		A	Analytic function
*	J	Conjugate			

1.1.4 Stochastic Processes

Standard Symbol	Computer Symbol	Name of Concept	Definition or Explanation	SI Unit
g^A, A_g		Time average of a function of a random variable	$A(g(t)) = \lim_{T\to\infty} \frac{1}{T}\int_0^T g(t)dt$	
$(xx)^C$, C_{XX}	XXC	Auto-covariance function of a stationary stochastic process	$x^{2F} - x^{F2}$	
$(xy)^C$, C_{xy}	XYC	Cross-covariance function of two stationary stochastic processes	$(xt)^F - x^F y^F$	
g^E, E_g	GE	Expected value of a function of a random variable	$E(g(x)) = \int_{-\infty}^{\infty} g(x)f_x(x)dx$	

Standard Symbol	Computer Symbol	Name of Concept	Definition or Explanation	SI Unit
x^{p}, f_x	XPD	Probability density function of a random variable	$\frac{dF_X}{dx}$	
$(xy)^{P}$, f_{xy}	XYPD	Joint probability density function of two random variables	$\frac{\partial F_{xy}}{\partial x \partial y}$	
x^{P}, F_x	XP	Probability distribution of a random variable		
$(xy)^{P}$, F_{xy}	XYP	Joint probability distribution function of two random variables		
H_{xy}^{A2}	PTXY	Power transform function, response amplitude operator, power transform in general	$H_{xy}H_{xy}^{*}$ $S_{xx}=H_{xy}^{A2}\ S_{yy}$ $S_{xx,\ ij}=H_{xy,ik}^{*}\ S_{yy,\ kl}\ H_{xy,\ il}$	
x^{nE}	XNE	n−th moment of a random variable	$E(X^{n})$	
$(xx)^{p}$, R_{xx}	XXC	Auto-correlative function of a stationary stochastic process	$E(x(t))x(t+\tau)$ $R_{xx}(\tau)=R_{xx}(-\tau)$ if x is ergodic then : $R_{xx}=A(x(t)x(t+\tau))$ $R_{xx}(\tau)=$ $=\int_0^{\infty}S_{xx}(\omega)\cos(\omega\tau)d\tau$	
$(xy)^{E}$, R_{xy}	XYC	Cross-correlation function of two stationary stochastic processes	$E(x(t)y(t+\tau))$ if x & y ergodic then : $R_{xy}=A(x(t)y(t+\tau))$ $R_{yx}(\tau)=R_{xy}(-\tau)$	
$(xx)^{s}$, S_{xx}	XXS	Power spectrum or auto-spectral power density function of stochastic process	$F_T(R_{XX})/\pi\ \omega\geq 0$ $S_{xx}=H_{xx}^{*}\ S_{yx}$	
$(xy)^{s}$, S^{xy}	XYS	Cross-power spectrum of two stationary stochastic processes	$\frac{F_T(R_{xy})}{\pi}=H_{xy}^{*}\ S_{yy}$ $\omega\geq 0$ $S_{yx}=S_{xy}^{*}$ $S_{yx}=H_{xy}S_{yy}$ in general $S_{yx,\ ij}=S_{yy,\ ik}H_{xy,\ jk}$	
X_{xy}^{2}	XY	Coherence function	$\frac{S_{xy}S_{xy}^{*}}{S_{xx}S_{yy}}$	

Standard Symbol	Computer Symbol	Name of Concept	Definition or Explanation	SI Unit
X^E, μ_x	XE	Expected or mean value of a random variable	E(x)	
x^D, σ_x	XD	Standard deviation of a random variable		
x^v, σ^2_x	XV	Variance of a random variable	$E(x^2)-E^2(x)$	
T	TC	Correlation time		
ζ		Sample output		
x		Random or stochastic process, stationary	$x(\zeta, t)$	

Prefix	Meanings	Prefix	Meanings
	Functions, operators		Functions, operators
C	Covariance	P	Probability distribution
CR	Correlation	S	Power spectrum
E	Expectation	D	Standard deviation
PD	Probability density	V	Variance

본 학회에서 입수한 중국공정조선학회 학보 "중국조선" 최근 호에 게재된 목차입니다.

中国造船工程学会学报

中国造船

目　录

中国造船工程学会学报

中国造船

第　110　期

目　录