資 料

ITTC 표준기호(3)

(ITTC Standard Symbols)

수조시험연구회(KTTC)

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

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

SECTION 1 GENERAL MECHANICS

1.3 SOLID BODY MECHANICS

1.3.1 Properties

Standard Symbol	Computer Symbol	Name of Concept	Definition or Explanation	SI Unit
I_{xx}	IXX	Roll moment of inertia		kg m²
I_{yy}	IYY	Pitch moment of inertia		kg m²
I_{zz}	IZZ	Yaw moment of inertia		kg m²
I_{xy}, I_{xz}	IXY, IXZ	Real products of inertia	IXY, IXZ	kg m²
I_{yz}	IYZ		IYZ	
κ_x, κ_{xx}	RDGX	Roll radius of gyration	$(\frac{I_{xx}}{m})^{\frac{1}{2}}$	m
κ_y, κ_{yy}	RDGY	Pitch radius of gyration	$(\frac{I_{yy}}{m})^{\frac{1}{2}}$	m
κ_z, κ_{zz}	RDGZ	Yaw radius of gyration	$(\frac{I_{zz}}{m})^{\frac{1}{2}}$	m

1.3.2 Forces

Standard Symbol	Computer Symbol	Name of Concept	Definition or Explanation	SI Unit
F_s, Q	FS	Shearing force		N
F, W	F, WT	Load, concentrated		N
K, M, N	MX, F(4)	Components of moment relative to body axes		Nm
M_x, M_y, M_z	MY, F(5)			
M_1, M_2, M_3	MZ, F(6)			
F_4, F_5, F_6				
X, Y, Z	FX, F(1)	Components of force relative to body axes		N
F_x, F_y, F_z	FY, F(2)			
F_1, F_2, F_3	FZ, F(3)			
M_B	MB	Bending moment in general	Appropriate sub scripts may be added (as M_{BH}, M_{BV})	Nm
M_T	MT	Twisting or torsional moment		Nm
q	UNQ	Load per unit length		N/m
w	WPUL	Weight per unit length		N/m
W, F	WT, F	Load, concentrated		N

1.3.3 Rigid Body Motions

Standard Symbol	Computer Symbol	Name of Concept	Definition or Explanation	SI Unit
p, q, r	OMGX, V(4)	Components of angular axes velocity relative to body axes		1/s
ω_x, ω_y, ω_z	OMGY, V(5)			
v_4, v_5, v_6	OMGZ, V(6)			
u, v, w	VX, V(1)	Components of linear velocity relative to body axes		m/s
u_x, u_y, u_z	VY, V(2)			
u_1, u_2, u_3	VZ, V(3)			
v_i	V(ℓ)	Components of linear generalized motion relative to body axes	i = 1, 2, 3	m/s
			i = 4, 5, 6	1/s
$\dot{u}$, $\dot{v}$, $\dot{w}$	DUDT	Rates of change of components of linear velocity relative to body axes		m/s^2
	DVDT			
	DWDT			

Standard Symbol	Computer Symbol	Name of Concept	Definition or Explanation	SI Unit
$\dot{p}$, $\dot{q}$, $\dot{r}$	DPDT DQDT DRDT	Rates of change of components of angular velocity relative to body axes		$1/s^2$
α	ACCA	Angular acceleration	$\frac{d\omega}{dt}$	$1/s^2$
α	ALFA	Angle of attack	The angle of the longitudinal body axis from the projection into the principal plane of symmetry of the velocity of the origin of the body axes relative to the fluid, positive in the positive sense of rotation about the y−axis	1
β	BET	Angle of drift or side−slip	The angle to the principal plane of symmetry from the velocity vector of the origin of the body axes relative to the fluid, positive in the positive sense of rotation about the z−axis	1
$\overline{\beta}$	BETM	Mean drift angle		1
γ	GAMR	Projected angle of roll or heel	The angular displacement about the x_o axis of the principal plane of symmetry from the vertical, positive in the sense of rotation about the x_o axis	1
θ	TETP	Angle of pitch or trim (positive bow up)		1
θ_A, Ψ_A	TETPA	Pitch amplitude		1
ϕ	PHIR	Angle of roll, heel or list (positive starboard side down)		1
ϕ_A	PHIRA	Roll amplitude		1
Ψ, X	PSIY	Angle of yaw, heading or course (positive bow to starboard)		1
Ψ_A, X_A	PSIYA	Yaw oscillation amplitude		1
$\overline{\Psi}$, $\overline{X}$	PSIYM	Mean yaw		1

1.4 ENVIRONMENTAL MECHANICS

1.4.1 Waves

Standard Symbol	Computer Symbol	Name of Concept	Definition or Explanation	SI Unit
a	AMP	Amplitude		m
a_i	AI	Discrete amplitude spectrum of a repeating wave	$\mu(t) = \Sigma a_i \cos(2\pi f_i t + \phi_i)$	m
a_c	AC	Zero crossing wave crest height		m
$a_{c,\ max}$	ACMAX	Maximum zero crossing crest height		m
a_T	AT	Zero crossing wave trough excursion		m
$a_{t,\ max}$	ATMAX	Maximum zero crossing wave trough excursion		m
b	B	Bandwidth of spectral revolution	Sampling frequency divided by the number of transform points	Hz
c	C	Phase velocity or celerity		m/s
c_o	CO	Deepwater wave celerity		m/s
c_g	VWG	Group velocity		m/s
C_r	CR	Average reflection coefficient		1
$C_r(f)$	CRF	Reflection coefficient function		1
$D(f, \theta)$		Directional spreading function	$S(f, \theta) = S_\eta(f) \cdot D(f, \theta)$	deg
f	F	Frequency	$\int_0^{2\pi} D(f, \theta)\, d\theta = 1$	Hz
f_p	FP	Spectral peak in frequency	Frequency at which $S_\eta(f)$ is a maximum	Hz
h	HD	Water depth		m
H	H	Wave height		m
H_d	HOD	Zero downcrossing wave height		m
$\overline{H}_d$	HAVD	Average zero downcrossing wave height		m
H_{mo}, H_s	HMO	Estimate of significant wave height	$4\sqrt{m_o}$	m
H_u	HOU	Zero upcrossing significant wave height		m
$\overline{H}_u$	HAVU	Average zero upcrossing wave height		m
H_v	HV	Wave height estimated from visual observation		m

Standard Symbol	Computer Symbol	Name of Concept	Definition or Explanation	SI Unit
$H_{1/3}$, d	H13D	Zero downcrossing significant wave height	Average of the highest one third zero downcrossing wave heights	m
$H_{1/3}$, u	H13U	Zero upcrossing significant wave height	Average of the highest one third zero upcrossing wave heights	m
H_σ	HSIGMA	Estimate of significant wave height from RMS of wave elevation record	$1\sigma_n$ where σ_n is the standard deviation of $\eta(t)$	m
L_w, λ	LWA	Wave length	Measured direction of wave propogation	m
m_n	MN	n−th moment of spectral density	$\int_{f1}^{f2} f^n S(f)\, df$	m^2/s^n
$S_i(\omega)$, $S_i(f)$	SIF	Incident spectral density		m^2/Hz
$S_r(\omega)$, $S_r(f)$	SRF	Reflected spectral density		m^2/Hz
$S_\eta(f)$, $S_\zeta(\omega)$	SZF	Wave spectral density		m^2/Hz
$S_\rho(f, \theta)$ $S_\zeta(\omega, \mu)$	STHETA	Directional spectral density		$m^2/Hz/deg$
T	T	Wave period	1/f	s
T_d	TD	Wave period by zero downcrossing		s
$\overline{T}_d$	TAVD	Average period by zero downcrossing	$\overline{T}_d=\overline{T}_u=\overline{T}$	s
$T_{H1/3}$, d	TH13D	Significant wave period, zero downcrossing	The average of periods of the highest one third of zero downcrossing wave heights	s
$T_{H1/3}$, u	TH13U	Significant wave period, zero upcrossing	The average of periods of the highest one third of zero upcrossing wave heights	s
T_m	TM	Average wave period		s
T_p	TP	Spectral peak period		s
T_R	TR	Record length		s
T_u	TU	Wave period by zero upcrossing		s
$\overline{T}_u$	TAVU	Average period by zero upcrossing		s
T_v	TV	Wave period obtained visually		s

Standard Symbol	Computer Symbol	Name of Concept	Definition or Explanation	SI Unit
$T_{0,1}$	TO1	Average period from moments	$\frac{m_0}{m_1}$	s
$T_{0,2}$	TO2	Average period from moments	$\sqrt{\frac{m_0}{m_2}}$	s
α, θ	ALPHA THETA	Wave direction		deg
δ, f	DF	Basic frequency increment in discrete Fourier analysis		Hz
$\eta(t)$	ETA	Instantaneous surface elevation referred to mean water level	z positive upwards convention	m
η_c	ETAC	Crest elevation referred to mean water level		m
η_T	ETAT	Trough elevation referred to mean water level		m
η_{max}	ETAMAX	Maximum surface elevation in a wave record		m
η_{min}	ETAMIN	Minimum surface elevation in a wave record		m
σ	SIGMA	Standard deviation or RMS if mean value is removed		m
τ	TAU	Shift variable time		s
ω	OMEGA	Angular frequency	$2\pi f$	rad/s
$\zeta(t)$	ZETA	Instantaneous surface elevation referred to mean water level	z positive upwards convention	m
C	CTAVD	Wave celerity	Velocity of wave crest	m/s
c_g	VWG	Group velocity of waves		m/s
f	FR	Frequency		1/s
L_w, λ	LW	Wave length	From crest to crest	m
$\tilde{T}$	TCAP	Apparent wave period (according to zero crossings)	The time elapsing between the occurrence of two successive upward crossings of zero	s
T	TCW	Wave period		s
$S_\zeta(\omega, \mu)$	S2ZET	Two dimensional spectral density		1
$S_\theta(\omega, \mu)$	S2TET			
etc.	etc.			

Standard Symbol	Computer Symbol	Name of Concept	Definition or Explanation	SI Unit
$S_\zeta(\omega)$	S1ZET	One dimensional spectral density		1
$S(\theta)$	S1TET			
etc.	etc.			
κ	CAPW	Wave number	$2\pi/\lambda$	1/m
$\overline{\lambda}$	LWA	Apparent wave length (according to zero crossings)	The horizontal distance between two successive upward crossings of zero	m
ζ	ZET	Instantaneous wave elevation		m
ζ_A	ZETA	Wave amplitude		m
ζ_W	ZETW	Height of a wave	Height of a wave from trough to crest	m

1.4.2 Ice Mechanics

Standard Symbol	Computer Symbol	Name of Concept	Definition or Explanation	SI Unit
S_I	SALTI	Salinity of ice	Weight of salt per unit weight of ice	1
S_W	SALTW	Salinity of water	Weight of dissolved salt per unit weight of saline water	1
t°_A	TEMPA	Temperature of air		℃
t°_I	TEMPI	Local temperature of ice		℃
t°_W	TEMPW	Temperature of water		℃
δ_I	DELI	Deflection of ice sheet	Vertical movement of ice surface	m
ε_I	STI	Ice strain	Elongation per unit length	1
$\dot{\varepsilon}_I$	STRAT	Strain rate	$\dot{\varepsilon}_I = \frac{\partial \varepsilon}{\partial \tau}$	1/s
μ_I	POISI	Poisson's ratio of ice		1
ν_A	NUA	Relative volume of air	Volume of gas pores per unit volume of ice	1
ν_B	NUB	Relative brine volume of dopant	Volume of liquid phase per unit volume of ice	1
ν_O	NUO	Total porosity	$\nu_O = \nu_A + \nu_B$	1
ρ_I	RHOI	Mass density of ice	Mass of ice per unit volume	kg/m^3
ρ_{SN}	RHOSN	Mass density of snow	Mass of snow per unit volume	kg/m^3
ρ_W	RHOW	Mass density of water		kg/m^3
ρ_Δ	RHOD	Density difference	$\rho_\Delta = \rho_W - \rho_I$	kg/m^3
σ_C	SIGCS	Compressive strength of ice		Pa
σ_F	SIGF	Flexural strength of ice		Pa
σ_T	SIGT	Tensile strength of ice		Pa
τ_S	TAUS	Shear strength of ice		Pa