Table 1 : Table of Hydrodynamic Coefficients for Heaving

Heaving	OSM	Present(NSM)
a_{33}	$\int (w/g + \rho M_1)\,dx$	$\int (w/g + \rho M_1)\,dx + U/\omega_e^2[\rho N_1]$
b_{33}	$\int \rho N_1 dx - U[\rho M_1]$	$\int \rho N_1 dx - U[\rho M_1]$
c_{33}	$\int 2\rho g y_w dx$	$\int 2\rho g y_w dx$
a_{35}	$-\int (w/g + \rho M_1)X dx$	$-\int (w/g + \rho M_1)X dx - U/\omega_e^2 \int \rho N_1 dx$ $- U/\omega_e^2[\rho N_1 X] + (U/\omega_e)^2[\rho M_1]$
b_{35}	$-\int \rho N_1 X dx + U\int \rho M_1 dx + U[\rho M_1 X]$	$-\int \rho N_1 X dx + U\int \rho M_1 dx + U[\rho M_1 X]$ $+ (U/\omega_e)^2[\rho N_1]$
c_{35}	$-\int 2\rho g y_w X dx + U\int \rho N_1 dx - U^2[\rho M_1]$	$-\int 2\rho g y_w X dx$

F_{w3c} F_{w3s}	OSM	$\zeta_a \int 2\rho g y_w c_1 c_2 \begin{pmatrix} \cos k^*x \\ \sin k^*x \end{pmatrix} dx$ $+ \omega \zeta_a \int \rho N_1 c_1 c_2 \begin{pmatrix} \sin k^*x \\ -\cos k^*x \end{pmatrix} dx$ $+ \omega \omega_e \zeta_a \int \rho M_1 c_1 c_2 \begin{pmatrix} -\cos k^*x \\ -\sin k^*x \end{pmatrix} dx$ $+ \omega U \zeta_a \left[\rho M_1 c_1 c_2 \begin{pmatrix} -\sin k^*x \\ \cos k^*x \end{pmatrix} \right]$
	NSM	$\zeta_a \int 2\rho g y_w c_1 c_2 \begin{pmatrix} \cos k^*x \\ \sin k^*x \end{pmatrix} dx$ $+ \omega_e \zeta_a \int \rho N_{10} c_1 c_2 \begin{pmatrix} \sin k^*x \\ -\cos k^*x \end{pmatrix} dx$ $+ \omega \omega_e \zeta_a \int \rho M_{10} c_1 c_2 \begin{pmatrix} -\cos k^*x \\ -\sin k^*x \end{pmatrix} dx$ $+ \omega U \zeta_a \left[\rho M_{10} c_1 c_2 \begin{pmatrix} -\sin k^*x \\ \cos k^*x \end{pmatrix} \right]$ $+ U \zeta_a \left[\rho N_{10} c_1 c_2 \begin{pmatrix} -\cos k^*x \\ -\sin k^*x \end{pmatrix} \right]$
	Present	$\zeta_a \int \int_C \rho g \cos(k y \sin\chi) dy \begin{pmatrix} \cos k^*x \\ \sin k^*x \end{pmatrix} dx$ $+ \omega_0^2 \zeta_a \int \rho M_{41} \begin{pmatrix} \cos k^*x \\ \sin k^*x \end{pmatrix} dx$ $+ \omega_0^2 / \omega_e \zeta_a \int \rho N_{41} \begin{pmatrix} -\sin k^*x \\ \cos k^*x \end{pmatrix} dx$ $+ \omega_0 / \omega_e U \zeta_a \left[\rho N_{41} \begin{pmatrix} \cos k^*x \\ \sin k^*x \end{pmatrix} \right]$ $+ \omega_0 U \zeta_a \left[\rho M_{41} \begin{pmatrix} \sin k^*x \\ -\cos {}^*x \end{pmatrix} \right]$

여기서 NSM의 파강제력에 있어 M_{10}, N_{10}은 파주파수 ω_0의 유체력이다.

또, $X = x - x_G$, $\overline{X} = x - x_G$ (파랑하중의 경우 $\overline{X} = x - x_1$), σ: 단면계수,

$k^* = k\cos\chi$, y_w: x단면의 수선의 반폭

$c_1 = \sin(k y_w \sin\chi)/(k y_w \sin\chi)$, $\qquad \chi \neq n\pi$

$\quad = 1.0$, $\qquad \chi = n\pi$, $n = 0, 1, 2, \cdots$

$c_2 = e^{-k\sigma d}$

Table 2 : Table of Hydrodynamic Coefficients for Pitching

Heaving	OSM	Present(NSM)
a_{53}	$-\int (w/g+\rho M_1)\overline{X}dx$	$-\int (w/g+\rho M_1)\overline{X}dx + U/\omega_e^2\int \rho N_1 dx$ $-U/\omega_e^2[\rho N_1\overline{X}]$
b_{53}	$-\int \rho N_1\overline{X}dx - U\int \rho M_1 dx + U[\rho M_1\overline{X}]$	$-\int \rho N_1\overline{X}dx - U\int \rho M_1 dx + U[\rho M_1\overline{X}]$
c_{53}	$-\int 2\rho g y_w\overline{X}dx$	$-\int 2\rho g y_w\overline{X}dx$
a_{55}	$\int (w/g+\rho M_1)X\overline{X}dx$	$\int (w/g+\rho M_1)X\overline{X}dx + U/\omega_e^2\int \rho N_1(\overline{X}-X)dx$ $+ (U/\omega_e)^2\int \rho M_1 dx + U/\omega_e^2[\rho N_1 X\overline{X}]$ $-(U/\omega_e)^2[\rho M_1 X]$
b_{55}	$\int \rho N_1 X\overline{X}dx - U\int \rho M_1(\overline{X}-X)dx$ $-U[\rho M_1 X\overline{X}]$	$\int \rho N_1 X\overline{X}dx - U\int \rho M_1(\overline{X}-X)dx$ $+ U^2/\omega_e^2\int \rho N_1 dx - U[\rho M_1 X\overline{X}]$ $- U^2/\omega_e^2[\rho N_1\overline{X}]$
c_{55}	$\int 2\rho g y_w X\overline{X}dx - U\int \rho N_1 X dx$ $- U^2\int \rho M_1 dx + U^2[\rho M_1 X]$	$\int 2\rho g y_w X\overline{X}dx$

M_{w5c} M_{w5s}	OSM	$\zeta_a \int 2\rho g y_w c_1 c_2 \overline{X}\begin{pmatrix} -\cos k^* x \\ -\sin k^* x \end{pmatrix} dx$ $+ \omega \zeta_a \int \rho N_1 c_1 c_2 \overline{X}\begin{pmatrix} -\sin k^* x \\ \cos k^* x \end{pmatrix} dx$ $+ \omega \omega_e \zeta_a \int \rho M_1 c_1 c_2 \overline{X}\begin{pmatrix} \cos k^* x \\ \sin k^* x \end{pmatrix} dx$ $+ \omega U \zeta_a \left[\rho M_1 c_1 c_2 \begin{pmatrix} \sin k^* x \\ -\cos k^* x \end{pmatrix} \right]$ $+ \omega U \zeta_a \int \rho M_1 c_1 c_2 \begin{pmatrix} -\sin k^* x \\ \cos k^* x \end{pmatrix} dx$
	NSM	$\zeta_a \int 2\rho g y_w c_1 c_2 \overline{X}\begin{pmatrix} -\cos k^* x \\ -\sin k^* x \end{pmatrix} dx$ $+ \omega_e \zeta_a \int \rho N_{10} c_1 c_2 \overline{X}\begin{pmatrix} -\sin k^* x \\ \cos k^* x \end{pmatrix} dx$ $+ \omega \omega_e \zeta_a \int \rho M_{10} c_1 c_2 \overline{X}\begin{pmatrix} \cos k^* x \\ \sin k^* x \end{pmatrix} dx$ $+ \omega U \zeta_a \left[\rho M_{10} c_1 c_2 \begin{pmatrix} \sin k^* x \\ -\cos k^* x \end{pmatrix} \right]$ $+ \omega U \zeta_a \int \rho M_{10} c_1 c_2 \begin{pmatrix} -\sin k^* x \\ \cos k^* x \end{pmatrix} dx$ $+ U \zeta_a \left[\rho N_{10} c_1 c_2 \overline{X}\begin{pmatrix} \cos k^* x \\ \sin k^* x \end{pmatrix} \right]$ $+ U \zeta_a \int \rho N_{10} c_1 c_2 \begin{pmatrix} -\cos k^* x \\ -\sin k^* x \end{pmatrix} dx$
	Present	$\zeta_a \int \int \rho g \cos(k y \sin \chi) dy \, \overline{X}\begin{pmatrix} -\cos k^* x \\ -\sin k^* x \end{pmatrix} dx$ $+ \omega_0^2 \zeta_a \int \rho M_{41} \overline{X}\begin{pmatrix} -\cos k^* x \\ -\sin k^* x \end{pmatrix} dx$ $+ \omega_0 / \omega_e U \zeta_a \int \rho N_{41} \begin{pmatrix} \cos k^* x \\ \sin k^* x \end{pmatrix} dx$ $+ \omega_0^2 / \omega_e \zeta_a \int \rho N_{41} \overline{X}\begin{pmatrix} \sin k^* x \\ -\cos k^* x \end{pmatrix} dx$ $+ \omega_0 U \zeta_a \int \rho M_{41} \begin{pmatrix} \sin k^* x \\ -\cos^* x \end{pmatrix} dx$ $+ \omega_0 / \omega_e U \zeta_a \left[\rho N_{41} \overline{X}\begin{pmatrix} -\cos k^* x \\ -\sin k^* x \end{pmatrix} \right]$ $+ \omega_0 U \zeta_a \left[\rho M_{41} \overline{X}\begin{pmatrix} -\sin k^* x \\ \cos^* x \end{pmatrix} \right]$

Table 3. Table of hydrodynamic Coefficients for Swaying

SWAY	OSM	Present(NSM)
a_{22}	$\int (w/g + \rho M_2)\,dx$	$\int (w/g + \rho M_2)\,dx + U/\omega_e^2[\rho N_2]$
b_{22}	$\int \rho N_2 dx - U[\rho M_2]$	$\int \rho N_2 dx - U[\rho M_2]$
c_{22}	0	0
a_{24}	$\int \rho M_2 l_\eta' dx$	$\int \rho M_2 l_\eta' dx + U/\omega_e^2 \rho N_2 l_w'$
b_{24}	$\int \rho N_2 l_w' dx - U[\rho M_2 l_\eta']$	$\int \rho N_2 l_w' dx - U[\rho M_2 l_\eta']$
c_{24}	0	0
a_{26}	$\int (w/g + \rho M_2) X dx$	$\int (w/g + \rho M_2) X dx + U/\omega_e^2 \int \rho N_2 dx - U^2/\omega_e^2[\rho M_2]$
b_{26}	$\int \rho N_2 X dx - U \int \rho M_2 dx - U[\rho M_2 X]$	$\int \rho N_2 X dx - U \int \rho M_2 dx - U[\rho M_2 X]$
c_{26}	$- U \int \rho N_2 dx + U^2[\rho M_2]$	$0 - U^2/\omega_e^2[\rho N_2]$

F_{w2c} F_{w2s}	OSM	$\zeta_a \int \int_C \rho g e^{-kz} \sin(ky\sin\chi)\,dz \begin{pmatrix} \sin k^*x \\ -\cos k^*x \end{pmatrix} dx$ $+\,\omega\zeta_a \int \rho N_2 c_3 \begin{pmatrix} \cos k^*x \\ \sin k^*x \end{pmatrix} dx$ $+\,\omega\omega_e\zeta_a \int \rho M_2 c_3 \begin{pmatrix} \sin k^*x \\ -\cos k^*x \end{pmatrix} dx$ $+\,\omega U\zeta_a \left[\rho M_2 c_3 \begin{pmatrix} -\cos k^*x \\ -\sin k^*x \end{pmatrix} \right]$
	NSM	$\zeta_a \int \int_C \rho g e^{-kz} \sin(ky\sin\chi)\,dz \begin{pmatrix} \sin k^*x \\ -\cos k^*x \end{pmatrix} dx$ $+\,\omega\zeta_a \int \rho N_2 c_3 \begin{pmatrix} \cos k^*x \\ \sin k^*x \end{pmatrix} dx$ $+\,\omega\omega_e\zeta_a \int \rho M_2 c_3 \begin{pmatrix} \sin k^*x \\ -\cos k^*x \end{pmatrix} dx$ $+\,\omega U\zeta_a \left[\rho M_2 c_3 \begin{pmatrix} -\cos k^*x \\ -\sin k^*x \end{pmatrix} \right]$ $+\,\omega/\omega_e U\zeta_a \left[\rho N_2 c_3 \begin{pmatrix} \sin k^*x \\ -\cos k^*x \end{pmatrix} \right]$
	Present	$\zeta_a \int \int_C \rho g e^{-kz} \sin(ky\sin\chi)\,dz \begin{pmatrix} \sin k^*x \\ -\cos k^*x \end{pmatrix} dx$ $+\,\omega_0^2\zeta_a \int \rho M_{42} \begin{pmatrix} \cos k^*x \\ \sin k^*x \end{pmatrix} dx$ $+\,\omega_0^2/\omega_e\zeta_a \int \rho N_{42} \begin{pmatrix} -\sin k^*x \\ \cos k^*x \end{pmatrix} dx$ $+\,\omega_0/\omega_e U\zeta_a \left[\rho N_{42} \begin{pmatrix} \cos k^*x \\ \sin k^*x \end{pmatrix} \right]$ $+\,\omega_0 U\zeta_a \left[\rho M_{42} \begin{pmatrix} \sin k^*x \\ -\cos^* x \end{pmatrix} \right]$

여기에서 $c_3 = \sin\chi \cdot e^{-kd/2}$

Table 4. : Table of hydrodynamic Coefficients for Yawing

YAW	OSM	Present(NSM)
a_{62}	$\int \rho(w/g + \rho M_2)\overline{X}dx$	$\int \rho(w/g + \rho M_2\overline{X})dx - U/\omega_e^2 \int \rho N_2 dx$
b_{62}	$\int \rho N_2\overline{X}dx + U\int \rho M_2 dx - U[\rho M_2\overline{X}]$	$+ U/\omega_e^2[\rho N_2\overline{X}] \int \rho N_2\overline{X}dx + U\int \rho M_2 dx - U[\rho M_2 X]$
c_{62}	0	0
a_{64}	$\int \rho M_2 l_\eta'\overline{X}dx$	$\int \rho M_2 l_\eta X' dx - U/\omega_e^2 \int \rho N_2 l_w' dx + \omega_e^2[\rho N_2 X l_w']$
b_{64}	$U\int \rho N_2 l_\eta' dx - U[\rho M_2 l_\eta'\overline{X}] + \int \rho N_2 l_w'\overline{X}dx$	$U\int \rho M_2 l_\eta' dx - U\rho M_2 l_\eta' X + \int \rho N_2 l_w' X dx$
c_{64}	0	0
a_{66}	$\int (w/g + \rho M_2 X\overline{X})dx$	$\int (w/g + \rho M_2)X\overline{X}dx + U/\omega_e^2 \int \rho N_2(\overline{X} - X)dx$ $+ (U/\omega_e)^2 \int \rho M_2 dx - U/\omega_e^2[\rho N_2 X\overline{X}]$
b_{66}	$\int \rho N_2 X\overline{X}dx - U\int \rho M_2(\overline{X} - X)dx$	$\int \rho N_2 X\overline{X}dx - U\int \rho M_2(\overline{X} - X)dx$ $+ (U/\omega_e)^2 \int \rho N_2 dx - U[\rho M_2 X\overline{X}] - (U/\omega_e)^2[\rho N_2\overline{X}]$
c_{66}	$- U\int \rho N_2 X dx - U^2\int \rho M_2 dx + U^2[\rho M_2 X]$	0

F_{w2c} F_{w2s}	OSM	$\zeta_a \int \int_C \rho g e^{-kz} \sin(ky\sin\chi) dz \overline{X} \begin{pmatrix} \sin k^*x \\ -\cos k^*x \end{pmatrix} dx$ $+ \omega \zeta_a \int \rho N_2 c_3 \overline{X} \begin{pmatrix} \cos k^*x \\ \sin k^*x \end{pmatrix} dx$ $+ \omega \omega_e \zeta_a \int \rho M_2 c_3 \overline{X} \begin{pmatrix} \sin k^*x \\ -\cos k^*x \end{pmatrix} dx$ $+ \omega U \zeta_a \int \rho M_2 c_3 \begin{pmatrix} \cos k^*x \\ \sin k^*x \end{pmatrix} dx$ $+ \omega/\omega_e U \zeta_a \int \rho N_2 c_3 \begin{pmatrix} -\sin k^*x \\ \cos k^*x \end{pmatrix} dx$
	NSM	$\zeta_a \int \int_C \rho g e^{-kz} \sin(ky\sin\chi) dz \overline{X} \begin{pmatrix} \sin k^*x \\ -\cos k^*x \end{pmatrix} dx$ $+ \omega \zeta_a \int \rho N_2 c_3 \overline{X} \begin{pmatrix} \cos k^*x \\ \sin k^*x \end{pmatrix} dx$ $+ \omega \omega_e \zeta_a \int \rho M_2 c_3 \overline{X} \begin{pmatrix} \sin k^*x \\ -\cos k^*x \end{pmatrix} dx$ $+ \omega U \zeta_a \int \rho M_2 c_3 \begin{pmatrix} \cos k^*x \\ \sin k^*x \end{pmatrix} dx$ $+ \omega/\omega_e U \zeta_a \int \rho N_2 c_3 \begin{pmatrix} -\sin k^*x \\ \cos k^*x \end{pmatrix} dx$ $+ \omega U \zeta_a \left[\rho M_2 c_3 \overline{X} \begin{pmatrix} -\cos k^*x \\ -\sin k^*x \end{pmatrix} \right]$ $+ \omega/\omega_e U \zeta_a \left[\rho N_2 c_3 \overline{X} \begin{pmatrix} \sin k^*x \\ -\cos k^*x \end{pmatrix} \right]$
	Present	$\zeta_a \int \int_C \rho g e^{-kz} \sin(ky\sin\chi) dz \overline{X} \begin{pmatrix} \sin k^*x \\ -\cos k^*x \end{pmatrix} dx$ $+ \omega_0^2 \zeta_a \int \rho M_{42} \overline{X} \begin{pmatrix} \cos k^*x \\ \sin k^*x \end{pmatrix} dx$ $+ \omega_0/\omega_e U \zeta_a \int \rho N_{42} \begin{pmatrix} -\cos k^*x \\ -\sin k^*x \end{pmatrix} dx$ $+ \omega_0^2/\omega_e \zeta_a \int \rho N_{42} \overline{X} \begin{pmatrix} -\sin k^*x \\ \cos k^*x \end{pmatrix} dx$ $+ \omega_0 U \zeta_a \int \rho M_{42} \begin{pmatrix} -\sin k^*x \\ \cos^* x \end{pmatrix} dx$ $+ \omega_0/\omega_e U \zeta_a \left[\rho N_{42} \overline{X} \begin{pmatrix} \cos k^*x \\ \sin k^*x \end{pmatrix} \right]$ $+ \omega_0 U \zeta_a \left[\rho M_{42} \overline{X} \begin{pmatrix} \sin k^*x \\ -\cos^* x \end{pmatrix} \right]$

Table 5. : Table of hydrodynamic Coefficients for Rolling

ROLL	OSM	Present(NSM)
a_{42}	$\int \rho M_2 l_\eta{}' dx$	$\int \rho M_2 l_\eta{}' dx + U/\omega_e^2 [\rho N_2 l_w{}']$
b_{42}	$\int \rho N_2 l_w{}' dx - U[\rho M_2 l_\eta{}']$	$\int \rho N_2 l_w{}' dx - U[\rho M_2 l_\eta{}']$
c_{42}	0	0
a_{44}	$\int (i_{xx} + \rho M_3) dx + U/\omega_e^2 [\rho N_3]$	$\int (i_{xx} + \rho M_3) dx + U/\omega_e^2 [\rho N_3]$
b_{44}	$\int \rho N_3 dx - U[\rho M_3]$	$\int \rho N_3 dx - U[\rho M_3]$
c_{44}	$\int w \cdot gm\, dx = W\, GM$	$\int w \cdot gm\, dx = W\, GM$
a_{46}	$\int \rho M_2 l_\eta{}' X dx$	$\int \rho M_2 l_\eta{}' X dx + U/\omega_e^2 \int \rho N_2 l_w{}' dx - U^2/\omega_e^2 [\rho M_2 l_\eta{}']$ $+ U/\omega_e^2 [\rho N_2 l_w{}' X]$
b_{46}	$\int \rho N_2 l_w{}' X dx - U \int \rho M_2 l_w{}' dx - U[\rho M_2 l_\eta{}' X]$	$\int \rho N_2 l_w{}' X dx - U \int \rho M_2 l_w{}' dx - U[\rho M_2 l_\eta{}' X]$ $- U^2/\omega_e^2 [\rho N_2 l_w{}']$
c_{46}	$- U \int \rho N_2 l_w{}' dx + U^2 [\rho M_2 l_\eta{}']$	0

F_{w4c} F_{w4s}	OSM	$\zeta_a \int \int_C \rho g e^{-kz} \sin(ky\sin\chi) \cdot \{ydy - (z - z_G)dz\} \begin{pmatrix} -\sin k^*x \\ \cos k^*x \end{pmatrix} dx$ $+ \omega\zeta_a \int \rho N_2 l_w' c_3 \begin{pmatrix} \cos k^*x \\ \sin k^*x \end{pmatrix} dx$ $+ \omega\omega_e\zeta_a \int \rho M_2 l_\eta' c_3 \begin{pmatrix} \sin k^*x \\ -\cos k^*x \end{pmatrix} dx$ $+ \omega U\zeta_a \left[\rho M_2 l_\eta' c_3 \begin{pmatrix} -\cos k^*x \\ -\sin k^*x \end{pmatrix} \right]$
	NSM	$\zeta_a \int \int_C \rho g e^{-kz} \sin(ky\sin\chi) \cdot \{ydy - (z - z_G)dz\} \begin{pmatrix} -\sin k^*x \\ \cos k^*x \end{pmatrix} dx$ $+ \omega\zeta_a \int \rho N_2 l_w' c_3 \begin{pmatrix} \cos k^*x \\ \sin k^*x \end{pmatrix} dx$ $+ \omega\omega_e\zeta_a \int \rho M_2 l_\eta' c_3 \begin{pmatrix} \sin k^*x \\ -\cos k^*x \end{pmatrix} dx$ $+ \omega U\zeta_a \left[\rho M_2 l_\eta' c_3 \begin{pmatrix} -\cos k^*x \\ -\sin k^*x \end{pmatrix} \right]$ $+ \omega/\omega_e U\zeta_a \rho N_2 c_3 \begin{pmatrix} \sin k^*x \\ -\cos k^*x \end{pmatrix}$
	Present	$\zeta_a \int \int_C \rho g e^{-kz} \sin(ky\sin\chi) \cdot \{ydy - (z - z_G)dz\} \begin{pmatrix} -\sin k^*x \\ \cos k^*x \end{pmatrix} dx$ $+ \omega_0^2 \zeta_a \int \rho M_{43} \begin{pmatrix} \cos k^*x \\ \sin k^*x \end{pmatrix} dx$ $+ \omega_0^2/\omega_e\zeta_a \int \rho N_{43} \begin{pmatrix} -\sin k^*x \\ \cos k^*x \end{pmatrix} dx$ $+ \omega_0/\omega_e U\zeta_a \left[\rho N_{43} \begin{pmatrix} \cos k^*x \\ \sin k^*x \end{pmatrix} \right]$ $+ \omega_0 U\zeta_a \left[\rho M_{43} \begin{pmatrix} \sin k^*x \\ -\cos^* x \end{pmatrix} \right]$