昭和　　年　　月　　日

2次元滑走板の境界条件について
(浸水長の変化に対応する解)

1. 序

Ⅰ. 定常問題.

1.1 速度ポテンシャル等、及 B.C. の誘導

1.2 解核　　I. Eq. の解析

1.3 浸水長の変化

1.4. 解について.

Ⅱ. 動揺問題.

1.1 速度ポテンシャル等.

1.2 解核.

1.3 浸水長の変化 (1)　　重力の無い場合
振動翼との比較

1.4　　〃　　(2).

1.5 解について.

特異解

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1. 定常型 $\varphi=0$

~~2. 動揺~~ 滑走板?

3. 振動翼

4. 滑走板 $(\varphi \neq 0)$　Wagner.
動揺

5. 動揺滑走板 $(\varphi \neq 0)$

— ~~特異解~~　7月

2次元 滑走板　8月 — 速度ポテンシャル

3次元 〃

1. 近似 3次元

近似解

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Bisplinghoff, Ashley, Halfman

Aeroelasticity

Chap 5　p. 188 — 293

" 7　380 — 420

$(y - \varphi)$

$\Psi = f(x) \; e^{i\omega t} + \dots$

$\frac{\partial \eta}{\partial t} + U \frac{\partial \eta}{\partial x} = v$

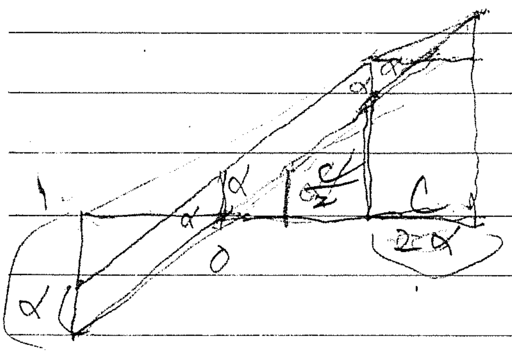
$v = \left(\frac{\partial}{\partial t} + U \frac{\partial}{\partial x}\right)\left(h + \beta x + \dots\right) e^{i\omega t}$

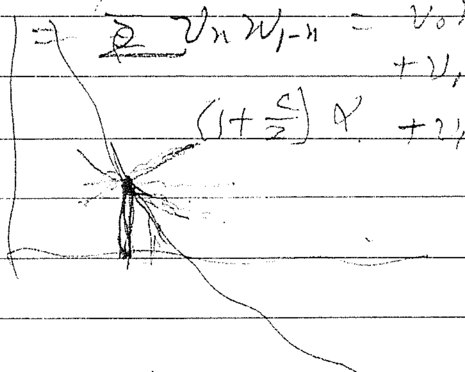
$e^{i\alpha x}$

$= U \alpha f_x +$

$$v \cdot w = \sum_{n=-\infty}^{\infty} v_n w_{m-n} \, e^{i m \omega t}$$

$$(v \cdot w)_1 = \sum v_n w_{1-n} = v_0 w_1 + v_1 w_0 + v_{-1} \dots$$





$$C = 2\left(\alpha + c\frac{\partial}{\partial c}\alpha\right)$$

$$\frac{\alpha'}{1+\frac{c}{2}} = \alpha$$

$$C = \frac{2\alpha}{1 - 2\frac{\partial}{\partial c}\alpha}$$

$$\left(1+\frac{c}{2}\right)\alpha' = \frac{c}{2}$$

α

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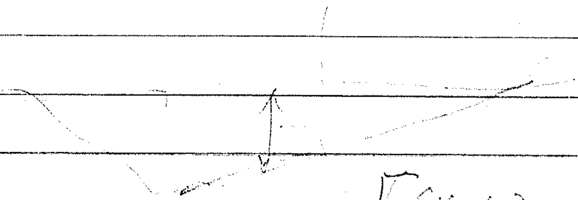

$F(x,t)$ $\qquad y = f(x)$

$$y = F(x,t) = h e^{i\omega t} + \theta x e^{i\omega t} + s f_x(x) e^{i\omega t}$$

$$\frac{D}{Dt}(y - F) = 0 \quad \Big| \quad \begin{array}{l} F_t = i\omega F \\ F_x = \end{array}$$

$$\cancel{\partial}\, v - \frac{\partial}{\partial t}F - U\frac{\partial}{\partial x}F_x + v = 0$$

$$\phi_y = v = (i\omega F = (i\omega - U\frac{\partial}{\partial x})\{h + \theta x + s f_x\}$$

$$\eta = \Phi_y = h + \theta x + s f_x$$

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$$\int_0^\infty \frac{e^{ikx}\,dk}{k-K+\mu i} \xrightarrow{x\to+\varepsilon} -\frac{\pi}{2}i - \lg(K\gamma x)$$

$$\xrightarrow{x\to-\varepsilon} -\frac{3\pi i}{2} - \lg(K\gamma|x|)$$

$k+\beta=u$

$$\int_0^\infty \frac{e^{-ikx}}{k+\beta}dk = e^{i\beta x}\int_\beta^\infty \frac{e^{-iux}}{u}du \qquad u=\frac{t}{x} \quad x>0.$$

$$= e^{i\beta x}\int_{\beta x}^\infty \frac{e^{-it}dt}{t}. \qquad \text{for } x>0.$$

$$= e^{i\beta x}\int_{\beta|x|}^\infty e^{it}dt \qquad u=-\cancel{\frac{t}{x}}=\frac{t}{|x|} \quad \text{for } x<0$$

$$\lim_{x\to 0}\int_{\beta|x|}^\infty \frac{\lambda t}{t}dt = \frac{\pi}{2}$$

$$\int_\varepsilon^\infty \frac{\cos t}{t}dt = \int_0^\varepsilon \frac{1-\cos t}{t}dt + \cancel{\int_\varepsilon} \lg\varepsilon\gamma - \int_0^z \frac{}{u}$$

$$\xrightarrow{\beta x\to+0} -\frac{\pi}{2}i - \lg(\gamma\beta x) \qquad \text{for } x>0.$$

$$\xrightarrow{\beta x\to-\varepsilon} +\frac{\pi}{2}i - \lg(\gamma\beta|x|) \qquad \text{for } x<0.$$

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$$S_2 = \frac{\cancel{\gamma}}{2\pi}\int_0^\infty \left[\frac{k}{A}e^{ikx} + \frac{k}{B}e^{-ikx}\right]dk$$

$$S_3 = \frac{\gamma}{2\pi i}\int_0^\infty \left[\frac{e^{ikx}}{A} - \frac{e^{-ikx}}{B}\right]dk$$

Euler

$$S_2 \xrightarrow[x>0]{} \frac{\cancel{1}}{2\pi}\left[\left(\frac{\alpha-K}{\alpha+K}\right)\left\{K\left(-\frac{\pi}{2}i - \lg(K\gamma x)\right) - \frac{\alpha^2}{K}\left(-\frac{\pi}{2}i - \lg\frac{\alpha^2\gamma}{K}x\right)\right\}\right.$$

$$\left. + \left(\frac{\alpha-\beta}{\alpha+\beta}\right)\left\{\beta\left(-\frac{\pi}{2}i - \lg(\gamma\beta x)\right) - \frac{\alpha^2}{\beta}\left(-\frac{\pi}{2}i - \lg\frac{\gamma\alpha^2 x}{\beta}\right)\right\}\right]$$

$-\pi i$ $\quad +\pi i$ $\quad -K(\alpha-K)^2$ $\quad +\beta(\alpha-$

$$= \frac{1}{2\pi}\left[\left(\frac{\pi}{2i} - \lg(\gamma x)\right)\left\{\left(\frac{\alpha-K}{\alpha+K}\right)\left(K - \frac{\alpha^2}{K}\right) + \frac{\alpha-\beta}{\alpha+\beta}\left(\beta - \frac{\alpha^2}{\beta}\right)\right\}\right.$$

$$+ \frac{-1}{2\pi}\left[+\left(\frac{\alpha-K}{\alpha+K}\right)\left\{K\lg K - \frac{\alpha^2}{K}\lg\left(\frac{\alpha^2}{K}\right)\right\}\right.$$

$$\left. + \left(\frac{\alpha-\beta}{\alpha+\beta}\right)\left(\beta\lg\beta - \frac{\alpha^2}{\beta}\lg\frac{\alpha^2}{\beta}\right)\right]$$

$$\frac{\alpha-K}{\alpha+K}\left(K - \frac{\alpha^2}{K}\right) + \frac{\alpha-\beta}{\alpha+\beta}\left(\beta - \frac{\alpha^2}{\beta}\right) = -K(\alpha-K)^2 - \beta(\alpha-\beta)^2$$

$$= -\gamma + \cancel{\gamma} = 0$$

$$S_2 \xrightarrow[x\to+0]{} -\frac{1}{2\pi}\left[\left(\frac{\alpha-K}{\alpha+K}\right)\left\{K\lg K - \frac{\alpha^2}{K}\lg\frac{\alpha^2}{K}\right\} + \frac{\alpha-\beta}{\alpha+\beta}\left\{\beta\lg\beta - \frac{\alpha^2}{\beta}\lg\frac{\alpha^2}{\beta}\right)\right]$$

$$\xrightarrow[x\to-0]{} -\frac{1}{2\pi}\left[\quad \text{〃} \quad\right]$$

$$+\frac{1}{2i}\underbrace{\left\{\left(\frac{\alpha-K}{\alpha+K}\right)\left(K - \frac{\alpha^2}{K}\right) + \left(\frac{\alpha-\beta}{\alpha+\beta}\right)\left(\beta - \frac{\alpha^2}{\beta}\right)\right\}}_{\gamma \sim \gamma}$$

$+2\gamma$ // jump

$J_3 \to$ jump なし

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$$\left(\frac{\partial}{\partial t} - U\frac{\partial}{\partial x}\right)\phi(x,y,t) = \cancel{\frac{1}{\rho}[\text{redacted}](x,y,t)} = \Pi(x,y,t)$$

$$\Pi(x,y,t) = \frac{-1}{\pi}\int_0^{c(t)} \frac{p(\xi,t)\,y\,d\xi}{(x-\xi)^2+y^2} \xrightarrow[y\to -0]{} p(x,t)$$

$$\left(\frac{\partial}{\partial t} - U\frac{\partial}{\partial x}\right)\eta(x,t) = -\phi_y(x,0,t)$$

$$\left(\frac{\partial}{\partial t} - U\frac{\partial}{\partial x}\right)\phi_y(x,0,t) = \Pi_y(x,0,t) = -\frac{1}{\pi}\int_0^c \frac{p(\xi,t)\,d\xi}{(x-\xi)^2}$$

$$= \int^t \Pi(x+U\overline{t-\tau}, y, \tau)\,d\tau \qquad -\tau = \frac{x-x}{U} - t$$

$$\phi(x,y,t) = \frac{-1}{U}\int^x \Pi\left(X, y, t+\frac{x-X}{U}\right)dX + f(x+Ut)$$

$$X = x + U(t-t)$$

$\cancel{\Phi}$ Displacement pot. Φ

$$\left(\frac{\partial}{\partial t} - U\frac{\partial}{\partial x}\right)\Phi(x,y,t) = \phi(x,y,t)$$

1. $$\Phi_y(x,0,t) = -\eta(x,t)$$

$$\cancel{x} f(x+Ut)$$

$$\Phi(x,y,t) = -\frac{1}{U}\int^x \phi\left(X, y, t+\frac{x-X}{U}\right)dX + f(x+Ut)$$

$$\cancel{X + U\left(t + \frac{x-X}{U}\right)}$$

$$\frac{1}{\pi}\int_0^c \frac{p(\xi,t)}{x-\xi}\,d\xi = g(x,t)$$

$$\boxed{g_x \quad f(X-t)}$$

$$\Pi_y(x,0,t) = g_x(x,t)$$

$$t + \frac{x-X}{U} = \tau$$

$$X = U(t-\tau) + x$$

$$\phi(x,y,t) = \int^t \Pi(x+U\overline{t-\tau}, y, \tau)\,d\tau$$

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$$I = \frac{1}{\pi}\int_0^c \frac{p(\xi, t)\,d\xi}{x-\xi}$$

$$p = \frac{A + Bx + Cx^2}{\sqrt{x(c-x)}}$$

$$I_n = \frac{\left(\frac{c}{2}\right)^{n+1}}{\pi}\int_0^c \frac{\xi^n\,d\xi}{(x-\xi)\sqrt{\xi(c-\xi)}}$$

$x = \frac{c}{2}(1 + \operatorname{ch} u)$, $\frac{c}{2}\operatorname{ch} u = x - \frac{c}{2}$

$\xi = \frac{c}{2}(1 + \cos\theta)$, $d\xi = -\frac{c}{2}\sin\theta\, d\theta$

$\sqrt{\xi(c-\xi)} = \frac{c}{2}\sin\theta$

$\operatorname{sh} u = \sqrt{\left(\frac{2x}{c} - 1\right)^2 - 1} = \sqrt{\frac{2x}{c}\left(\frac{2x}{c} - 2\right)} = \frac{2}{c}\sqrt{x(x-c)}$

$$I_n = \frac{\left(\frac{c}{2}\right)^{n+1}}{\pi}\int_0^\pi \frac{(1+\cos\theta)^n\,d\theta}{\cos\theta - \operatorname{ch} u}$$

$$\frac{1}{\operatorname{ch} u - \cos\theta} = \frac{1}{\operatorname{sh} u}\sum_{n=0}^{\infty}\varepsilon_n e^{-nu}\cos n\theta$$

$$I_n = \frac{\left(\frac{c}{2}\right)^{n+1}}{\pi\operatorname{sh} u}\sum_{m=0}^{\infty}\varepsilon_m e^{-mu}\int_0^\pi \cos m\theta\,(1+\cos\theta)^n\,d\theta$$

$1 + \cos$

$(1 - 2\cos\theta + \cos^2\theta$

$$I_0 = \frac{1\left(\frac{c}{2}\right)}{\operatorname{sh} u} \rightarrow \frac{1\left(\frac{c}{2}\right)}{i\sin\theta}$$

$-\pi < \alpha < 0$ $\quad y<0$ $(0 < x < c)$

$$I_1 = \frac{11}{\operatorname{sh} u}\left(1 + e^{-u}\right) \longrightarrow \frac{1}{i\sin\theta}(1 + \cos\theta - i\sin\theta)$$

1.

$2\cos$

$$I_2 = \frac{\left(\frac{c}{2}\right)}{\operatorname{sh} u}\left(\frac{3}{2} + 2e^{-u} + \frac{1}{2}e^{-2u}\right) \rightarrow \frac{\left(\frac{c}{2}\right)}{i\sin\theta}\left(\frac{3}{2} + 2\cos\theta + \frac{1}{2}\cos\theta - 2i\sin\theta - \frac{1}{2}\sin 2\theta\right)$$

$\frac{3}{2} + 2\operatorname{ch} u + \frac{1}{2}\operatorname{ch} 2u$

$(1 + \operatorname{ch} u)^2 \quad - 2 - \operatorname{ch} u$

$i\sin\theta(2 + \cos$

$$I_0 = \frac{\frac{c}{2}}{\sqrt{x(x-c)}}$$

$$I_1 = \frac{\frac{c}{2}}{\sqrt{x(x-c)}}\left(1 + \frac{2x}{c} - 1 - \frac{2}{c}\sqrt{x(x-c)}\right)$$

$$= \frac{x}{\sqrt{x(x-c)}} - 1$$

$$I_2 = \frac{\frac{c}{2}\left(\frac{2x}{c}\right)^2}{\sqrt{x(x-c)}} - 2 - \left(\frac{2x}{c} - 1\right)$$

$x = \frac{c}{2}u$

$$= \frac{u^2}{\sqrt{u(u-2)}} - u - 1 = \frac{u}{\sqrt{1 - \frac{2}{u}}} - (1+u) = u\left(1 + \frac{1}{u}\right) - 1$$

$$\left(\sqrt{\frac{x}{x-c}}-1\right)_x = \frac{1}{2\sqrt{x(x-c)}}$$

$$\phi_{,y} = \int_0^t A\, I_{1x}(x+v\overline{t-\tau}, 0, \tau)\, d\tau = \int$$

$$I_{1x} = \frac{1}{2\sqrt{x(x-c)}} - \frac{1}{2}\frac{\sqrt{x}}{(x-c)^{\frac{3}{2}}} = \frac{x-c-x}{2\sqrt{x}(x-c)^{\frac{3}{2}}}$$

$x = c(t_0)$

$\eta = vt + u\alpha$

$$\phi_{,y} = -\frac{1}{2}\int_0^{t_0} \frac{A(\tau)c(\tau)\, d\tau}{\sqrt{x+v\overline{t-\tau}}\,\{x+v\overline{t-\tau}-c(\tau)\}^{\frac{3}{2}}}$$

$$\eta = -\frac{1}{2}\int_0^t d\tau' \int_0^{\tau'} \frac{A(\tau)c(\tau)\, d\tau}{\sqrt{x+v\overline{t-\tau'}+v\overline{\tau'-\tau}}\,\{x+v\overline{t-\tau}-c(\tau)\}^{\frac{3}{2}}}$$

$$= -\frac{1}{2}\left[t\int_0^{t} \frac{A(\tau)c(\tau)\, d\tau}{(\quad)} - \int_0^t \tau A \right.$$

$$\eta = -\frac{1}{2}\int_0^t \frac{(t-\tau)A(\tau)c(\tau)\, d\tau}{\sqrt{x+v\overline{t-\tau}}\,\{x+v\overline{t-\tau}-c(\tau)\}^{\frac{3}{2}}}$$

$c(\tau)$　$\eta(c, t)$

$~~c(t) =~~$ $x = c(t)$ at t

において $\eta(x,t) = \eta_0(t) + \alpha x$

$= ~~vt~~ + \alpha c(t)$

$c > x > 0$

$\eta = -vt + \alpha x$ for $c(t) > x > 0$

$\eta(c(t), t) = -vt + \alpha c(t)$

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家の弁明

理論は役に立つか

はじめに

1. 理論とは何か　　実験
(実際、実用)

~~2.~~ 理論の有用性とその分類

2. 役に立つとはどういう事か

~~3.~~ モデルと仮説

~~4.~~ 有用性とは何か (社会的側面)
　　　理解性

おわりに

3. 事例

開発

定性的
定量的
統計的
量的　時空間的
How
when
which
Who
Who