I ſ G ſ ☆

@ fG f , f
G
F @ f G f 3 G @
F f -
@ @
A f @ f G f f @ - -
f , f 4 @ f f G -

N @ f @ U FF f
A A W (A) A 8) A A 1)

$$\delta , \quad (4)$$

F f

$$\hat{\sigma} \quad 2\pi\sigma .$$

U @ F @ ,

$$\quad ^2 \; \pi \int_{-\infty}^{\infty} \frac{\omega^2}{4} \; \omega \; \omega, \quad (6)$$

(3)

$$G \quad ^2 \; \pi \int_{-\infty}^{\infty} \frac{\pi^2\omega^2}{} \; 2\pi\omega \quad 2 \quad \omega.$$

C @ @ f @ @ $2\pi\omega$,

$$G \quad ^2 \; \pi \int_{-\infty}^{\infty} \frac{\pi^2\omega^2}{} \; 2\pi\omega \quad 2 \; 2\pi\omega \; \omega \quad ^2 \; \pi \int_{-\infty}^{\infty} \frac{\pi^2\omega^2}{} \; 2\pi\omega \; \hat{} \; \frac{}{\pi} \; \omega \; \omega. \quad (8)$$

f G f $\frac{\pi^2\omega^2}{}$ @ (8)
F ϵ, @ (8) (
) $\omega <$, ϵ / π $\leqslant \frac{1}{2}$, f $\hat{}$ ξ

$$\xi < \frac{}{2\pi} \; \frac{\epsilon}{\pi}. \quad (9)$$

W f A A L G
$\lambda >$ γ_λ λ^2, F f $\hat{\gamma}\;\xi$, (A 4))

$$\lambda \; \xi \quad \hat{\gamma}_\lambda \; \xi \quad ^2. \quad (10)$$

$\in \mathbb{Z}$

U @ A @ 3, f $\xi \leqslant \frac{N}{2}$

$$\hat{} \; \xi \approx \frac{1}{\lambda \; \frac{\xi}{vN}} \; \hat{} \; \gamma_\lambda \; v\xi \quad , \quad (11)$$

g A 26) N v A A @N
@ - f(9) N 2, (11) (8)

$$G \approx \tilde{G} \quad ^2 \; \pi \int_{-\infty}^{\infty} \frac{\pi^2\omega^2}{} \; 2\pi\omega \quad \hat{} \; \frac{\gamma_\lambda \; v \frac{}{\pi} \; \omega}{\lambda \; \frac{/\pi \;\; \omega}{vN}}. \quad (12)$$

C @ @ @ (12)

$$\tilde{G} \quad ^2 \; \pi \; \hat{} \int_{-\infty}^{\infty} \frac{\pi^2\omega^2}{} \; 2\pi\omega \; \frac{\gamma_\lambda \; v \frac{}{\pi} \; \omega}{\lambda \; \frac{/\pi \;\; \omega}{vN}} \; \omega. \quad (13)$$

@ 1 (A A), ξ f $\xi < \frac{1}{4}$ G A ,
@ (1 3) ; fG @ f
N ,

$$\pi \int_{-\infty}^{\infty} \frac{\pi^2\omega^2}{\ } \; 2\pi\,\omega \;\; \lambda \;\; v^2 \;\; \frac{\ }{\pi} \;\; \omega \;\;\; ^2 \;\; \frac{\pi\omega \;^2}{vN \;^2\lambda} \;\; \omega$$

$$\frac{vN \;\; \lambda\pi}{\kappa} \times \frac{\lambda^2 v^2 N^2 \;\; \pi \;\; w \;\;^2 \;\; \lambda \;^2\pi^2 \;\; ^2\pi^2 \;\; \lambda v^2 N^2 \;\;^2}{\kappa}$$

$$\times \;\; 2\,\frac{\;^2\;\pi^2 \;\; \lambda^2 v^4 N^2 \;\; \pi \;\; \lambda^2 v^3 N^2}{\kappa} \;,$$

$$\kappa \;\; \pi^2 \lambda v^2 N^2 \;\; \pi^2 \;\; \lambda^2 v^4 N^2 \;. \tag{14}$$

,

$$\tilde{G} \;\; \frac{vN \;\; \lambda\pi}{\kappa} \;\; \frac{\pi^2 \;\; \lambda v^2 N^2 \;\;^2 \;\; 2 \;\; \pi^2 \;\; \lambda^2 v^4 N^2}{\kappa} \;\;^2$$

$$\times \;\; \tilde{r} \;\; \frac{\lambda^2 v^2 N^2 \;\; \pi \;\; w \;\;^2}{\kappa} \;\; \frac{2 \;\; \pi \;\; \lambda^2 v^3 N^2}{\kappa} \;, \tag{1}$$

$$\tilde{r} \;\; \tilde{r} \;\; \frac{\lambda \;\pi^2 \;\;^2}{\kappa} \;. \tag{16}$$

f (3) (1) f
@ 4 1 99 84 6 9 9626 9 9626 81 2283491 1 6 () F1 4 4( )-2 31 (433)-3331 (@F1 1 38 9644301 3 -

(1) W @ @

f @ , 1 W @ @ $\frac{1}{2}, \frac{1}{2}$,

@ f , @ f , fa

(@)

M f , f @ ϵ, x s_j, f

$^2 \leqslant \epsilon$,

$\leqslant \frac{\epsilon}{\ }$.

f , K C_k,

s_{ϵ} 4 4 9 (M - 3 2 1

$\frac{1}{2}, \frac{1}{2}$

. iW @ f FF[@ f

iW f @ f f f
@ [- f @ .
N = 1 2 M fFF[, f @ f 3 FF[
f N = 1 28 FF[f N = 81 92
F [1 @ 3, -
,
[1 , a < 1 38 [f , [1 -
f

5. Conclusions

iW -8 8 8 iW 8 8-4l 4 (iW)-239 (8) 3 f ,

@ Γ @ f

, , , ,

F

M f ,

$, \lambda\ \xi \quad \hat{\gamma}_\lambda\ \xi\ ,\ ^2,$ A .4

$, \in \mathbb{Z}$

A f P ' f A(9) @

$$\mathscr{P}^{v} \quad \infty \quad 2\pi \quad \xi \;\hat{}\; vN\xi \; \hat{\gamma}_{\lambda} \; \xi \quad \xi, \quad \infty \qquad \text{A 1}$$

, ,

$$\mathscr{P}^{v} \quad \tfrac{1}{2} \quad 2\pi \quad \xi \quad \hat{} \; vN \; \xi \quad , \quad \hat{\gamma}_{\lambda} \; \xi \quad , \quad \xi. \quad \tfrac{1}{2} \quad {}_{,\,\in\mathbb{Z}} \qquad \text{A 11}$$

W @ $\mathbb{R}$ A(1) A(11), f fλ, ξ , $\hat{\gamma}_{\lambda}$ ξ , 1 / ,
@ @
, @ f(11) f F , f f

$$F \; \xi \quad \mathscr{P}^{v} \;) \quad 2\pi \quad \xi, \quad {}_{\in\mathbb{Z}} \qquad \text{A 1 2}$$

$$F \; \xi \quad \hat{} \; vN \; \xi \quad , \quad \hat{\gamma}_{\lambda} \; \xi \quad , \quad . \quad {}_{,\,\in\mathbb{Z}} \qquad \text{A 1 3}$$

@ f(1 3) ξ @

Then

$$E_\infty \leqslant 1 \quad \hat{\varphi} \;\; \alpha \quad \frac{1}{C \; , \alpha} \;\; {}_{, \in \mathbb{Z}} \quad C \;\; , \, , \alpha \;\; \hat{\varphi} \quad , \quad \alpha \; .$$

f$\hat{\varphi}$ f @ , 1 $\hat{\varphi}$ α
@ 1 = 1

@ ξ f $\xi \leqslant \frac{N}{2}$, α α $\frac{1}{2v}$
F @ f $v = 2$, $\xi < \frac{1}{4}$, $\hat{\varphi}$ ξ -
, $\hat{\varphi}$ $\xi \pm 1$, $\lambda <$ 1 4 F $\lambda =$ 1 4
fγ_λ 1 6,1 6 , A 9) @ f33 ,
23 f - , f

(2) C

$$F\ \xi \qquad \sum_{-\frac{vN}{2}}^{\frac{vN}{2}-1} \mathscr{P}^v \quad 2\pi\ \xi \qquad \text{A 1 6}$$

FFT

(3) $F(\xi_j)$ $\lambda\ \xi$

A.2.2. Fast evaluation of the Fourier series at unequally spaced points

W @ @ f f
f , @
L T

$$\xi \quad \frac{F\ \xi/v}{\lambda\ \xi/v},$$

F(ξ) A 1 2) $a_\lambda(\xi)$ A 4) C f @

$$\hat{f}\ \xi \quad \sum^{\frac{N}{2}-1}$$

∞ ∞∞∞ ∞∞∞∞∞ ∞∞∞ ∞ /∞∈∞

$$\int_{\infty}^{\infty} \hat{G}\left(\frac{\xi}{v}\right) \tilde{\mathscr{P}}^{v} \quad \xi \quad \xi, \qquad \text{A .2}$$

$$\hat{G}\ \xi \quad \sum_{\frac{N}{2}}^{\frac{N}{2}\ 1} \frac{\quad}{\quad \lambda\ \frac{1}{vN})} \quad \frac{2\pi\ \xi}{N}. \qquad \text{A .21}$$

(A 19) (A 2)

$$\int_{\infty}^{\infty} \sum_{\in\mathbb{Z}} \hat{G}\ \frac{}{v}\ \gamma_\lambda\ vN \quad N\xi\ , \quad , \qquad \text{A .22}$$

$$\sum_{\in\mathbb{Z}} \hat{G}\ \frac{}{v}\ \gamma_\lambda\ v\xi \quad . \qquad \text{A .23}$$

N Ĝ ( ) ,

$$\tilde{\ } \quad \frac{\quad}{\lambda\ \frac{}{vN}}, \quad \frac{N}{2} \leqslant \ \leqslant \frac{N}{2}\ 1\ ; \qquad \text{A .24}$$

A FFT $\frac{vN}{2}\ 1$, $\frac{vN}{2}$, $\hat{G}\ \frac{}{v}$ F

Algorithm 2.

(1) C (A 24)
(2) A FFT $\hat{G}\ \frac{}{v}$
(3) C ξ (A 23)

A.2.3. Evaluation of unequally spaced FFT at unequally spaced points

W (A 14), $\in \frac{1}{2}, \frac{1}{2}$ $\xi \in \frac{N}{2}, \frac{N}{2}$

Algorithm 3.

(1) C

$$\mathscr{P}^{v} \quad \gamma_\lambda\ vN \quad \frac{}{vN}\ , \quad \frac{v^2N}{2}, \ldots, \frac{v^2N}{2}\ 1 \qquad \text{A .2}$$

( ) $\frac{v}{2}, \frac{v}{2}$

(2) λ,

$$\frac{\mathscr{P}^{v}}{\lambda\ \frac{}{v^2N})}$$