I f G f ☆

@ 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)

$$\delta \qquad (4)$$

F f

$$\hat{\ }\ \sigma \quad 2\pi\,\sigma \qquad (5)$$

U @ F @ ,

$$\frac{\pi}{\ } \quad \frac{\omega^2}{4} \ \omega \quad \omega, \qquad (6)$$

(3)

$$G \quad \frac{\pi}{\ } \quad \frac{\pi^2\omega^2}{\ } \ 2\pi\,\omega \quad 2 \quad \omega. \qquad (7)$$

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

$$G \quad \frac{\pi}{\ } \quad \frac{\pi^2\omega^2}{\ } \ 2\pi\,\omega \quad 2 \ 2\pi\omega \quad \omega \quad \frac{\pi}{\ } \quad \frac{\pi^2\omega^2}{\ } \ 2\pi\,\omega \ \hat{\ } \ \frac{\ }{\pi} \ \omega \quad \omega. \qquad (8)$$

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

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

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

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

$\mathbb{Z}$

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

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

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

$$G \ \tilde{G} \quad \frac{\pi}{\ } \quad \frac{\pi^2\omega^2}{\ } \ 2\pi\,\omega \quad \hat{\ } \ \frac{\gamma_\lambda \ v \ \frac{\ }{\pi} \ \omega}{\lambda \ \frac{\ /\pi \ \omega}{vN}}. \qquad (12)$$

C @ @ @ (12)

$$\tilde{G} \quad \frac{\pi}{\ } \quad \hat{\ } \quad \frac{\pi^2\omega^2}{\ } \ 2\pi\,\omega \ \frac{\gamma_\lambda \ v \ \frac{\ }{\pi} \ \omega}{\lambda \ \frac{\ /\pi \ \omega}{vN}} \ \omega. \qquad (13)$$

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

$$\frac{\pi}{\ } \qquad \frac{\pi^2\omega^2}{\ } \quad 2\pi\,\omega \quad \lambda \quad v^2 \quad \frac{\ }{\pi} \quad \omega \qquad {}^2 \quad \frac{\pi\omega\ {}^2}{vN\ {}^2\lambda} \quad \omega$$

$$\frac{vN \quad \lambda\pi}{\kappa} \qquad \frac{\lambda^2 v^2 N^2 \quad \pi \quad w \quad {}^2 \quad \lambda\ {}^2\pi^2 \quad {}^2\pi^2 \quad \lambda v^2 N^2 \quad {}^2}{\kappa}$$

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

$$\kappa \quad \pi^2 \lambda v^2 N^2 \quad \pi^2 \quad \lambda^2 v^4 N^2 . \qquad (1\ 4)$$

[,

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

$$\tilde{r} \qquad \frac{\lambda^2 v^2 N^2 \quad \pi \quad w \quad {}^2}{\kappa} \qquad \frac{2 \quad \pi \quad \lambda^2 v^3 N^2}{\kappa} \ , \qquad (1\ \ )$$

$$\tilde{r} \quad r \qquad \frac{\lambda \quad \pi^2 \quad {}^2}{\kappa} \ . \qquad (1\ 6)$$

[f (3) (1) f
@ 4 1 99 84 6 [9 9626 9 9626 81 2283491 1 6 [() [F 4 4( )-2 31 (433)-3331 (@F1 38 964436 3 -

(1) W @ @

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

@ f , @ f , fa

(@)

M , 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 f FF [, f @ f 3 FF [
f N = 1 28 FF [f N = 8 1 92
F [1 @ 3, -
,
[1 , a < 1 38 [f , [1 -
f

5. Conclusions

iW -8 8 8 iW 8 8-4 1 4 (iW)-239 (8) 3 f ,

@ Γ @ f

, , , ,

F

M f ,

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

A f ' f (A 9) @

$$\mathscr{P}^{v} \quad 2\pi \quad \xi \ \hat{} \ vN\xi, \hat{\gamma}_{\lambda} \ \xi \quad \xi, \tag{A 10}$$

, ,

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

W @ $\mathbb{R}$ (A 10) (A 11), f fλ, ξ , $\hat{\gamma}_{\lambda}$ ξ , 1 ,
@ @
, @ f(A 11) f F , f f

$$F \ \xi \quad \mathscr{P}^{v} \ ) \ 2\pi \ \xi, \qquad \mathbb{Z} \tag{A 12}$$

$$F \ \xi \quad \hat{} \ vN \ \xi \ \ldots \hat{\gamma}_{\lambda} \ \xi \ \ldots . \qquad \mathbb{Z} \tag{A 13}$$

@ f(A 13) ξ @

Then

$$E \leqslant 1 \quad \hat{\varphi} \quad \alpha \quad \frac{1}{C \quad , \alpha} \quad \mathbb{Z} \quad C \quad , \alpha \, \hat{\varphi} \quad \alpha .$$

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 -

, $\hat{\varphi}$ ξ 1 , $\lambda <$ 1 4 F $\lambda =$ 1 4

fγ_{λ} 1 6,1 6 , A 9) @ f33 ,

23 f - , f

(2) C

$$F\ \xi \quad \sum_{-\frac{\nu N}{2}}^{\frac{\nu N}{2}-1} \mathscr{P}^{\nu} \quad 2\pi\ \xi \qquad \textbf{A}\ 16$$

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

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

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

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

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

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

(A.19) (A.2)

$$\hat{G}\left(\frac{\ }{v}\right)\gamma_{\lambda}\, vN\tilde{\ }\ \tilde{\ }\ \hat{\ }\ N\xi, \quad \mathbb{Z} \qquad (A.22)$$

$$\hat{\ }(\xi) \quad \hat{G}\left(\frac{\ }{v}\right)\gamma_{\lambda}\, v\xi \quad \mathbb{Z}. \qquad (A.23)$$

N $\hat{G}$ ( ) ,

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

A FFT $\tilde{\ }\ \frac{vN}{2}\ 1 \quad \frac{vN}{2}$ $\hat{G}\left(\frac{\ }{v}\right)$ W F

Algorithm 2.

(1) C $\tilde{\ }$ (A.24)
(2) A FFT $\hat{G}\left(\frac{\ }{v}\right)$
(3) C $\hat{\ }(\xi)$ (A.23)

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

W (A.14), $\left[-\frac{1}{2},\frac{1}{2}\right)$ $\xi \in \left[-\frac{N}{2},\frac{N}{2}\right)$ -

Algorithm 3.

(1) C

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

( ) $\left[-\frac{v}{2},\frac{v}{2}\right)$

(2) λ,

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