TOAS

Stochastic

contains everything except

tobs = tdet (ctaue) + n timing model Residuals St = tobs - tdet (Cest) = tdet (Crue) - tdet (Cest) +n =7 St = tdet (Cest +E) - tdet (Cest) +N = tdet (Cest) +) tdet (Cest + E) | E - tdet (Cest) +n

de | E | +0(E2) = Meth design matrix
only depends on decivatives
of timing model * in practice this pracedure is iterated

by using either a standard weighted least

squares fit or a generalized least

Squares fit.

Likelihood n Follows Gaussian with unknown covariance p(n/0) = l exp (-1 nTc-'n) => $p(st | \phi, \epsilon) = \frac{1}{det(2\pi c)}$ exp $(-\frac{1}{\epsilon}(st - M\epsilon)^T c^{-1}(st - M\epsilon))$ let g = MTC-'St + [= MTC-'M log-likelihood -> log p(St/Ø, E) = p(St/Ø, O)=ETg- =ET/E maximize $\log \Lambda$ -7 0= $\partial \log \Lambda = g - \Pi \hat{\epsilon}$ ML &= [" = (MTC-'M)" MTC-'St Oz= Joliga (MTC-1M) = Joliga (MTC-1M)) so-called post-fit residuals Stret = St - Mê = (I - M(MTC-'M)-'MTC-') St = RSt

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	White noise eaugriance
	N-170 T
	N=(n=n) -> polf of noise
	p(n/owne)= (exp(z'nTN'n)
	JdetOTTN EQUAD
	components of N -> Nijik = Ex Wij + Qx Sij
	ij-labol TOA mumber, k labels backend
	Full Likelihood Function
	P.(St E, a, j, Pointe) = (St-Fe-Me-U; N'(St-Fe-Me-U;))
	Priors
	$p(j J_{\kappa}) = \exp\left(\frac{1}{2}iTJ^{-1}\right) \qquad p(q q) = \exp\left(\frac{1}{2}aTQ^{-1}q\right)$ $\int_{c} \det\left(2\pi J\right) \qquad \int_{c} \det\left(2\pi Q^{-1}q\right) dq$
	$\frac{P(\epsilon X) = \exp(\frac{-i}{2} \epsilon^T X^{-i} \epsilon)}{\int d\epsilon^{\dagger} c_{711} X X } \times \sqrt{\epsilon}$
	J= JxSi; Pin= [10h, of 10h, of
	[10.10k]
American	

Posterior P(E,a,i, Ouhie, Jr. Pn) & p(stle,a,i, Pan) p(il)x) p(alpn) Eijia are nuisance parameters let T= [M FU] b= [E] Prior is now p(b/Ø)= exp(2bBb) likelihood p(st/b, Ø) = exp(-1/2 (st-Tb)'N"(st-Tb)) X EXP(-1/6TB-16) posterior p 66,0/8tda just like before, d= TTN'8t h= 5-1 02 = Jdios (2")

ran write likelihood 98 P(St/b, Ø) = exp(-3[StTN-St - dTE-'d]) JdetCzTN) Jolet CzTB) x exp(-; (b-b) [5-1(b-b)) Marginalize $p(8t|\emptyset) = \int db \ p(8t|b,\emptyset) = \int \frac{(z_{ij})^{d_{im}b}}{\det \Sigma}$ · Marginalized tilelihood P(St(0) = exp(== [StN-8t - 275-4]) (2Ti)din N Let (N) Let (B) Let (E)