

FFT TRANSFORM WORKING

$TSTART := \text{time}(1)$

MY CONVENTION

$$F(t) = \frac{1}{2\pi} \int_{-\infty}^{\infty} f(\omega) e^{-i\omega t} d\omega$$

$$f(\omega) = \int_{-\infty}^{\infty} F(t) e^{i\omega t} dt$$

TIME DOMAIN FUNCTION

$tmax := 1 \cdot 10^{-6}$

$tmin := 1 \cdot 10^{-9}$

$Nt := 10^4$

$\Delta t := \frac{tmax - tmin}{Nt}$

$\Delta t = 9.990 \cdot 10^{-11}$

$k := [1..Nt]$

$t_k := k \cdot \Delta t$

$\min(t) = 9.990 \cdot 10^{-11}$

$\max(t) = 9.990 \cdot 10^{-7}$

$Nt := \text{length}(k)$

$Nt = 1 \cdot 10^4$

$E_o := 5 \cdot 10^5$

$\alpha := 4 \cdot 10^6$

$\beta := 480 \cdot 10^6$

$t_o := \frac{\ln\left(\frac{\beta}{\alpha}\right)}{\beta - \alpha}$

$t_o = 1.0058 \cdot 10^{-8}$

$Norm := \exp(-\alpha \cdot t_o) - \exp(-\beta \cdot t_o)$

$Norm = 0.9526$

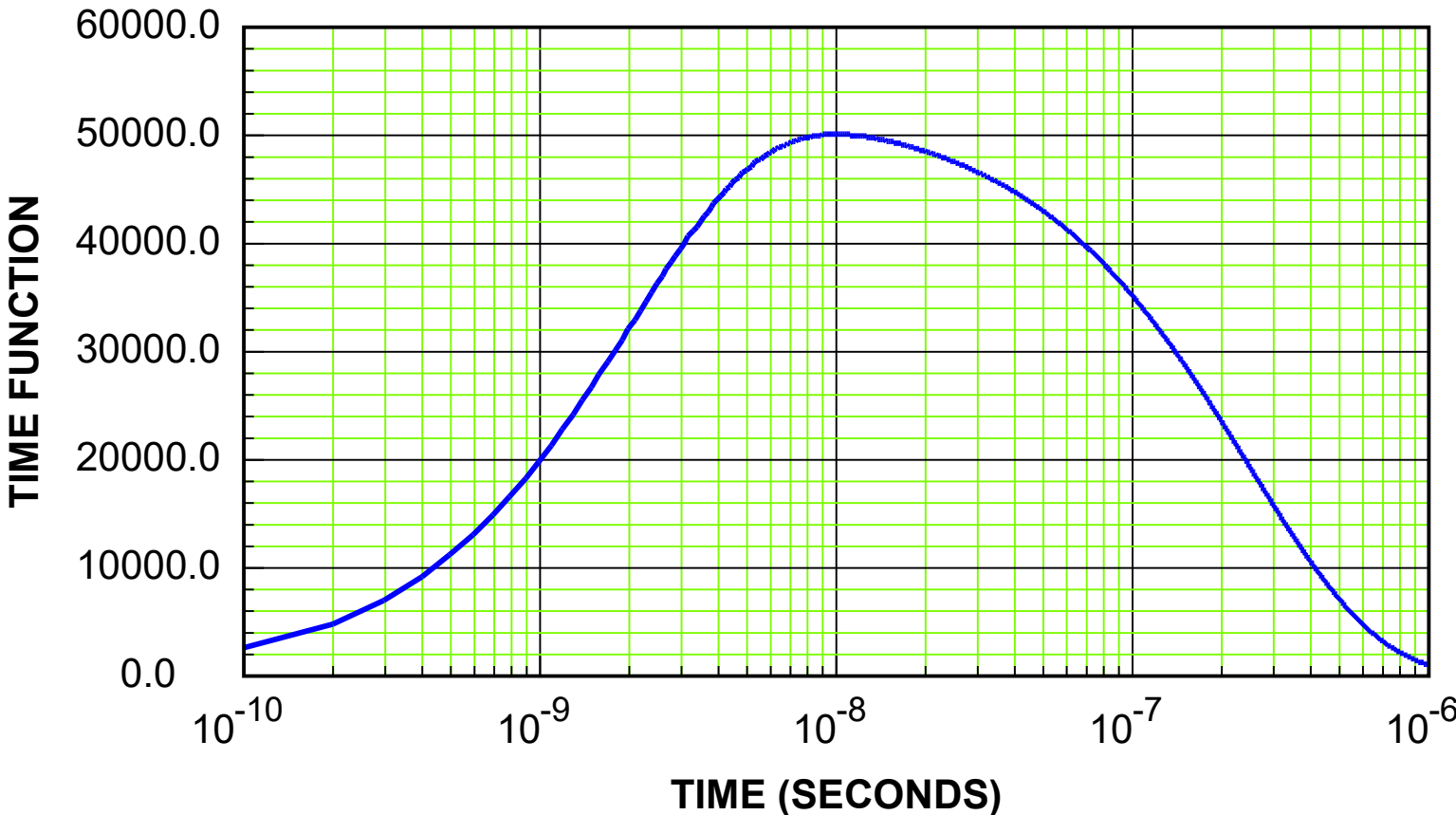
$EE_k := \frac{E_o}{Norm} \cdot \left(e^{-\alpha \cdot t_k} - e^{-\beta \cdot t_k} \right)$

$\max(EE) = 5 \cdot 10^5$

$\min(EE) = 9.652 \cdot 10^3$

$tplot := \text{eval}(\text{augment}(t, EE))$

DOUBLE EXPONENTIAL TIME FUNCTION



tplot

FREQUENCY DOMAIN FUNCTION

$f_{max} := 10^9$ $f_{min} := 10^2$ $\Delta f := 1 \cdot 10^4$ $Nf := \frac{f_{max} - f_{min}}{\Delta f} = 1.000 \cdot 10^5$ $n := [1 \dots Nf]$

$f_n := \text{if } n = 1$ 10^{-2} else $n \cdot \Delta f$

$\omega_n := 2 \cdot \pi \cdot f_n$

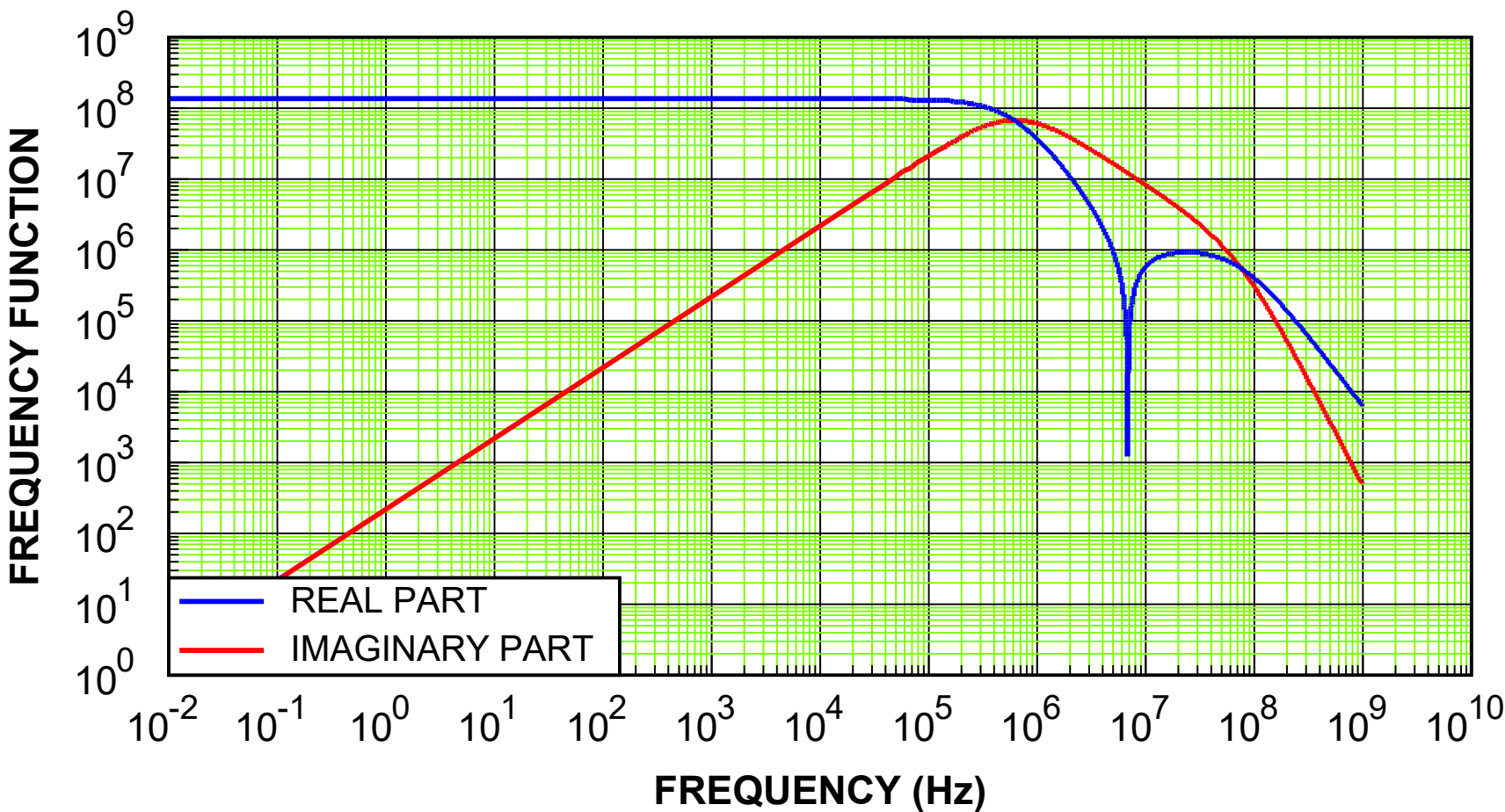
$n := [1 \dots \text{length}(f)]$ $Nf := \text{length}(f)$ $Nf = 1 \cdot 10^5$ $\min(f) = 1.000 \cdot 10^{-2}$ $\max(f) = 1.000 \cdot 10^9$

$E\omega_n := \frac{E_o}{Norm} \cdot \left(\frac{1}{\alpha - i \cdot (\omega_n)} - \frac{1}{\beta - i \cdot (\omega_n)} \right) \cdot Nf \cdot \Delta f$ $RE\omega_n := \left| \text{Re} \left(E\omega_n \right) \right|$ $\max(RE\omega) = 1.301 \cdot 10^8$

$Rplot := \text{eval} \left(\text{augment}(f, RE\omega) \right)$ $\min(RE\omega) = 1.169 \cdot 10^3$

$IE\omega_n := \left| \text{Im} \left(E\omega_n \right) \right|$ $Iplot := \text{eval} \left(\text{augment}(f, IE\omega) \right)$

DOUBLE EXPONENTIAL FREQUENCY FUNCTION



$Rplot$ $Iplot$

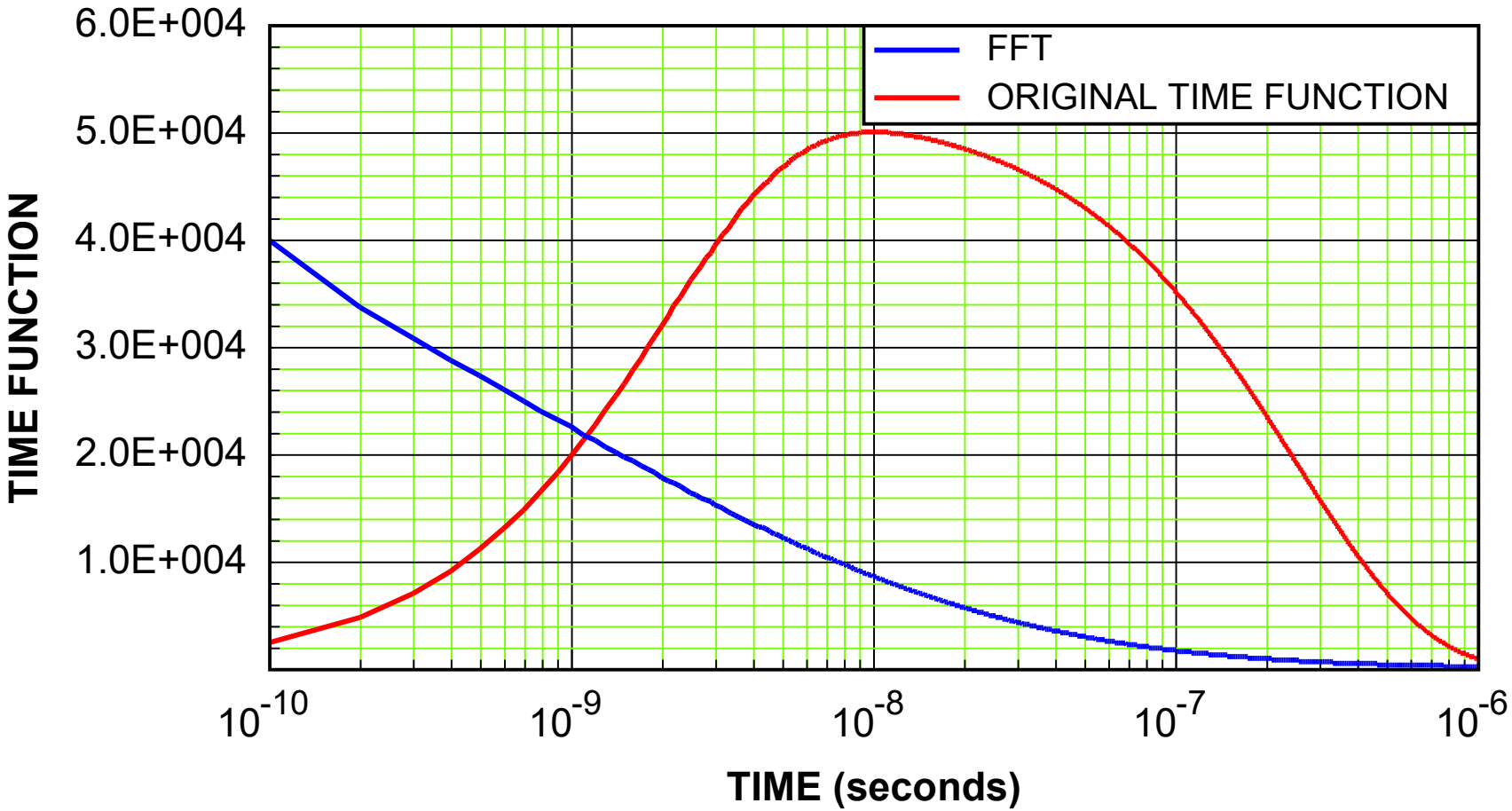
DEVELOP IFFT TRANSFORM

$FFT := \text{ifft}(E\omega)$ $N := \text{length}(FFT)$ $N = 1.000 \cdot 10^5$

$j := [1 \dots N]$ $\Delta t = 9.990 \cdot 10^{-11}$ $tt_j := j \cdot \Delta t$ $FFT_j := \left| FFT_j \right|$ $\max(FFT) = 4.413 \cdot 10^5$ $\min(FFT) = 6.507 \cdot 10^2$

$Fplot := \text{eval} \left(\text{augment}(tt, FFT) \right)$ $Eplot := \text{eval} \left(\text{augment}(t, EE) \right)$

DOUBLE EXPONENTIAL TIME FUNCTION



$\left\{ \begin{array}{l} F_{plot} \\ E_{plot} \end{array} \right.$

$\text{time}(1) - TSTART = 336.97 \text{ s}$

—END OF WORKSHEET—