Simulations results with new TCE values

This report discusses the simulation of GMRT servo mechanical system with new parameter values of the system as calculated by TCE. The previous simulation uses the lumped model as shown in figure 1 . For present simulation the model has been modified as shown in figure 2 . Table 1 gives values used in old and new simulation.

No major change was seen in step response of new and old simulation.. Figure 3 shows the bode plot of closed velocity loop. Figure 4 shows the sine sweep response of for simulation with new values. The addition of new inertia element jq for quadripod and feed modeling gives rise to resonance feature at 0.8 Hz. This resonance feature has been seen in lrf plots of few antennae as shown in figure 5 . Also from simulation it is seen that variation in slew ring viscous friction bg affects the anti-resonance dip amplitude value at 0.8 Hz and 1.2 Hz. Also a very high value of bg like 1.9e6 can completely washes out any resonance feature in frequency response of the velocity loop. Such a response with no resonance peaks and anti-resonance dips is found in few antennae as shown in figure 6

Parameters	Old value	New value	Reference/Comment for new value
Motor and gear box Inertia J_m	0.066768	0.066768	TCE value 0.0242
slew ringInertia J_g	3.5	2908	TCE Slew ring inertia
Controlled Inertia J_c	$2 \times 0.995 \times 10^6$	5.43734×10^5	TCE yoke inertia
Uncontrolled Inertia J_{uc}	10.9×10^6	6.8×10^6	TCE Dish, cradle, bullgear inertia
quadripod and FPS inertia J_q	-	4.86×10^5	TCE quadripod and FPS inertia
Motor Viscous Friction B_m	.005424	.005424	experimentally calculated
slew ring Viscous friction B_g	4379.2	4379.2	need additional info from TCE
Controlled Inertia viscous friction B_c	7.8336×10^6	5.9996×10^5	considered damping of .01 for yoke
Uncontrolled Inertia viscous friction B_{uc}	1.34368×10^7	1.3854×10^5	considered damping of .01 for dish
Quadripod B_q viscous friction B_q	-	$5.0541e \times 10^4$	considered damping of .01 for quadripod
Motor to pinion spring constant K_{mg}	10^7	10^7	gearbox specification sheet
Pinion to controlled inertia spring constant K_{gp}	5.0864×10^9	5.43734×10^7	TCE yoke stiffness
Controlled inertia to uncontrolled inertia spring constant K_{ad}	1.428×10^9	705.625×10^6	TCE dish stiffness
quadripod stiffness K_q	-	13.14×10^6	TCE quadripod stiffness
Slew ring gear Ratio N_s	-	12.6	-
Gear box gear ratio N	-	1488	-

Table 1: Azimuth axis mechanical parameters

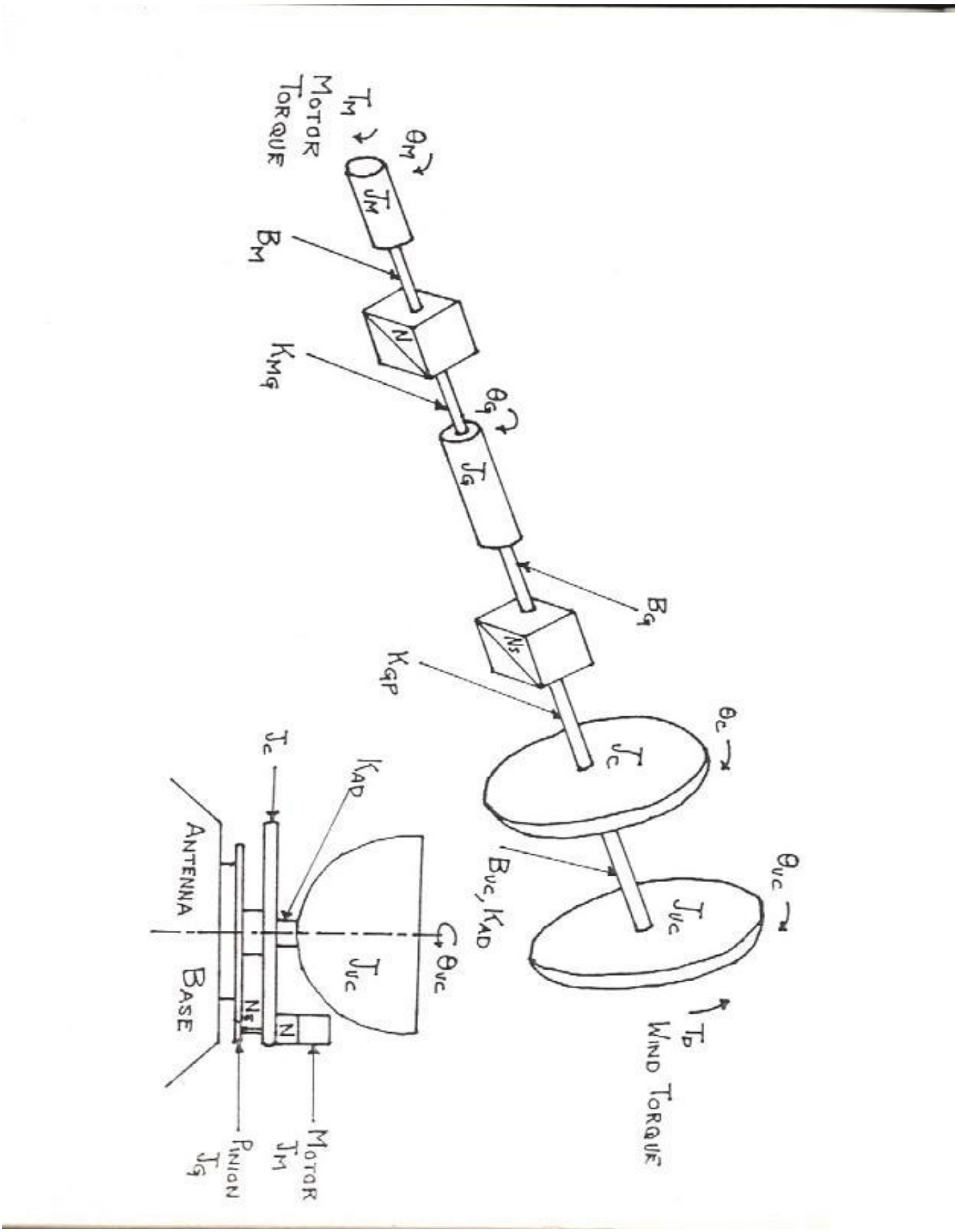

Figure 1: original lumped mechanical model for GMRT

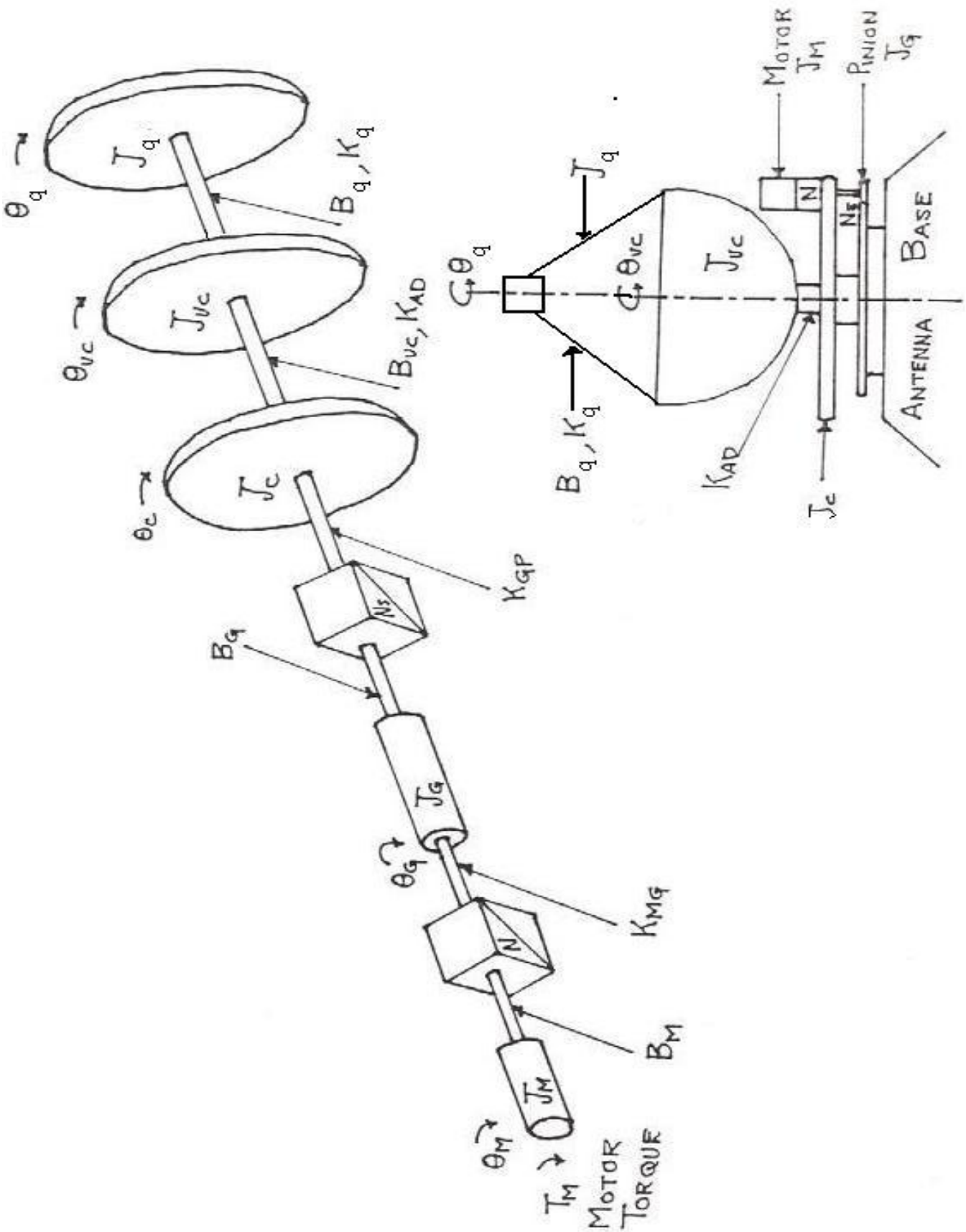

Figure 2: Modified mechanical model for GMRT

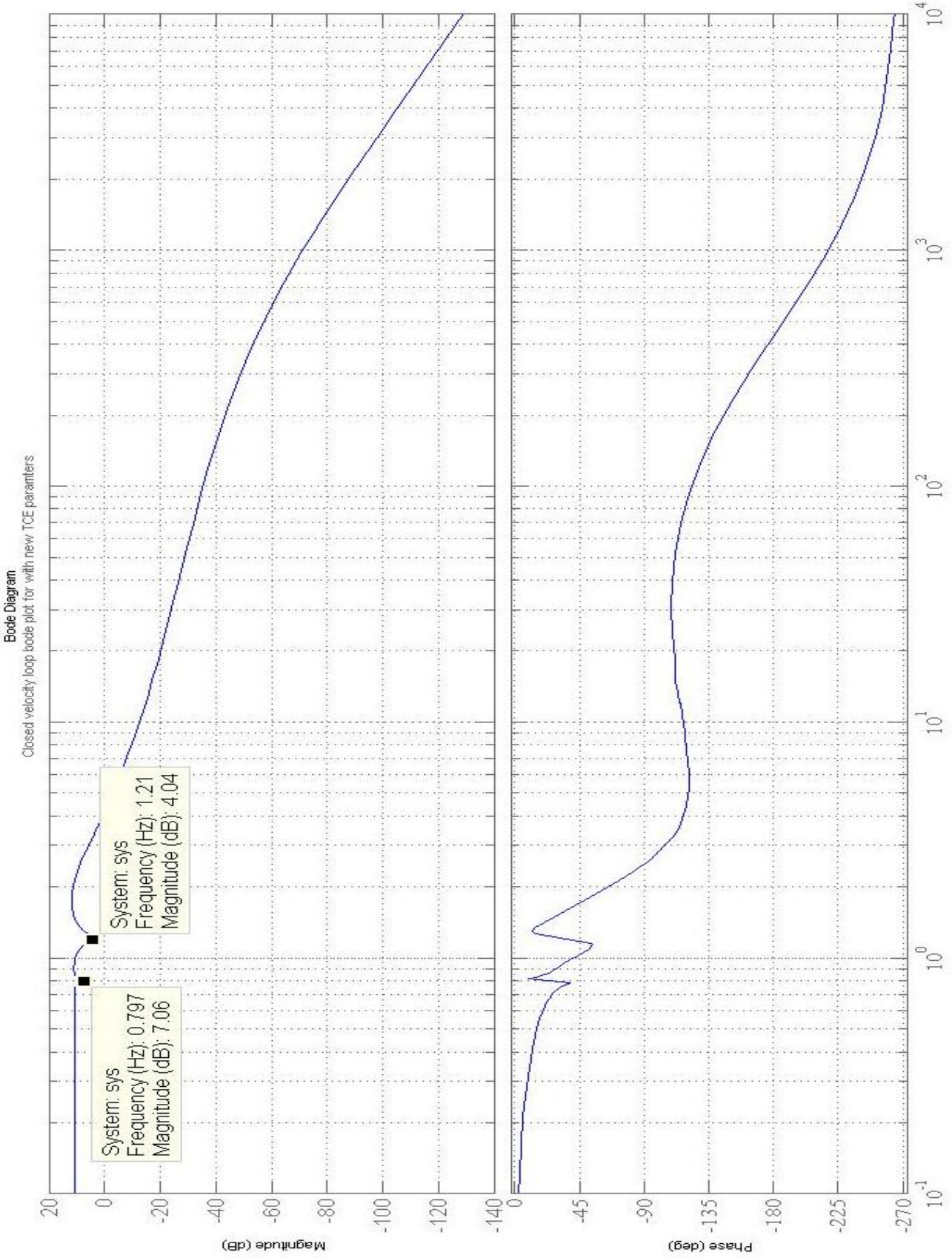

Figure 3: Closed velocity loop bode plot with new TCE parameters

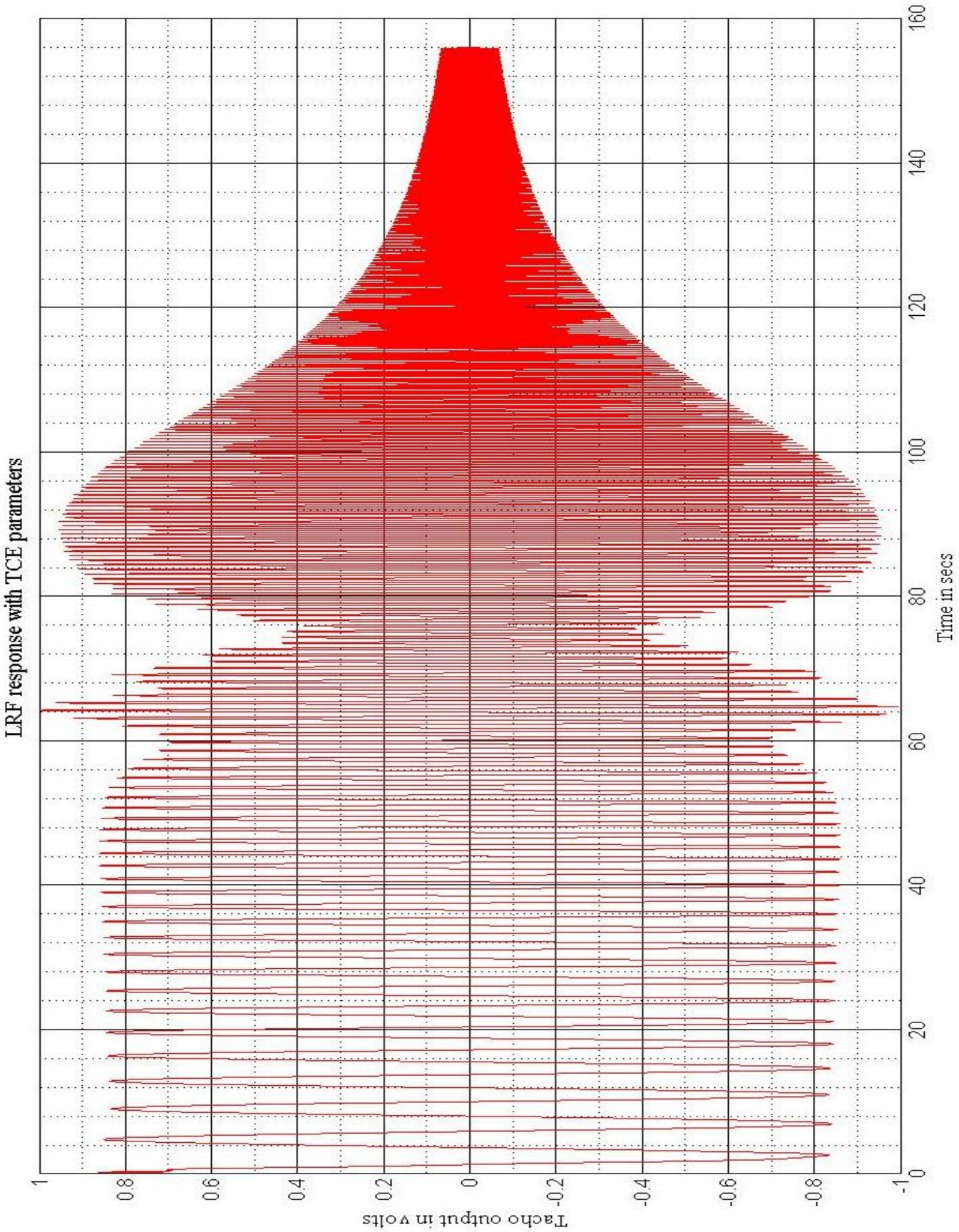

Figure 4: lrf of simulation with TCE parameters and additional inertia for quadripod

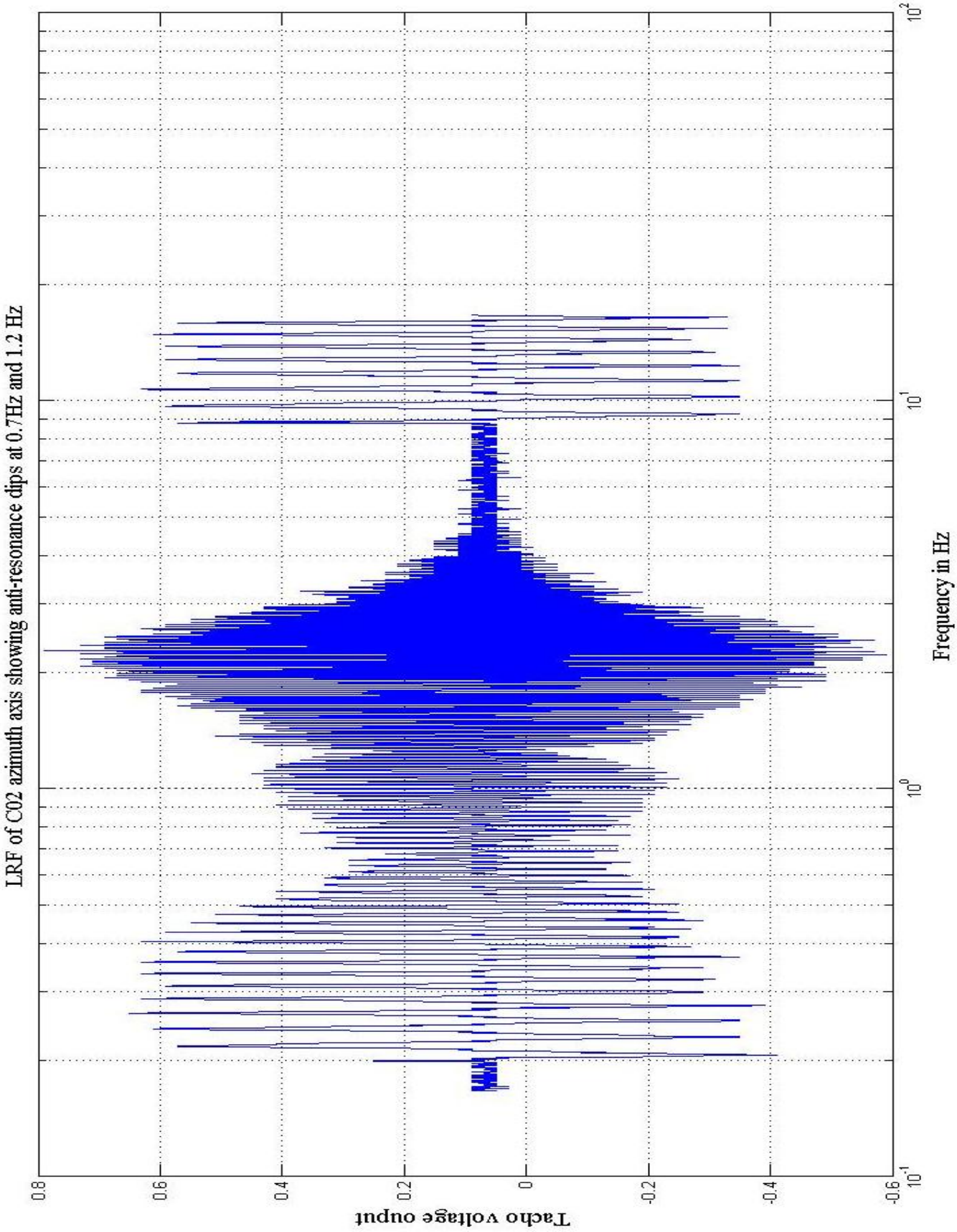

Figure 5: LRF of C02 azimuth axis showing dip at 0.7Hz and 1.2 Hz

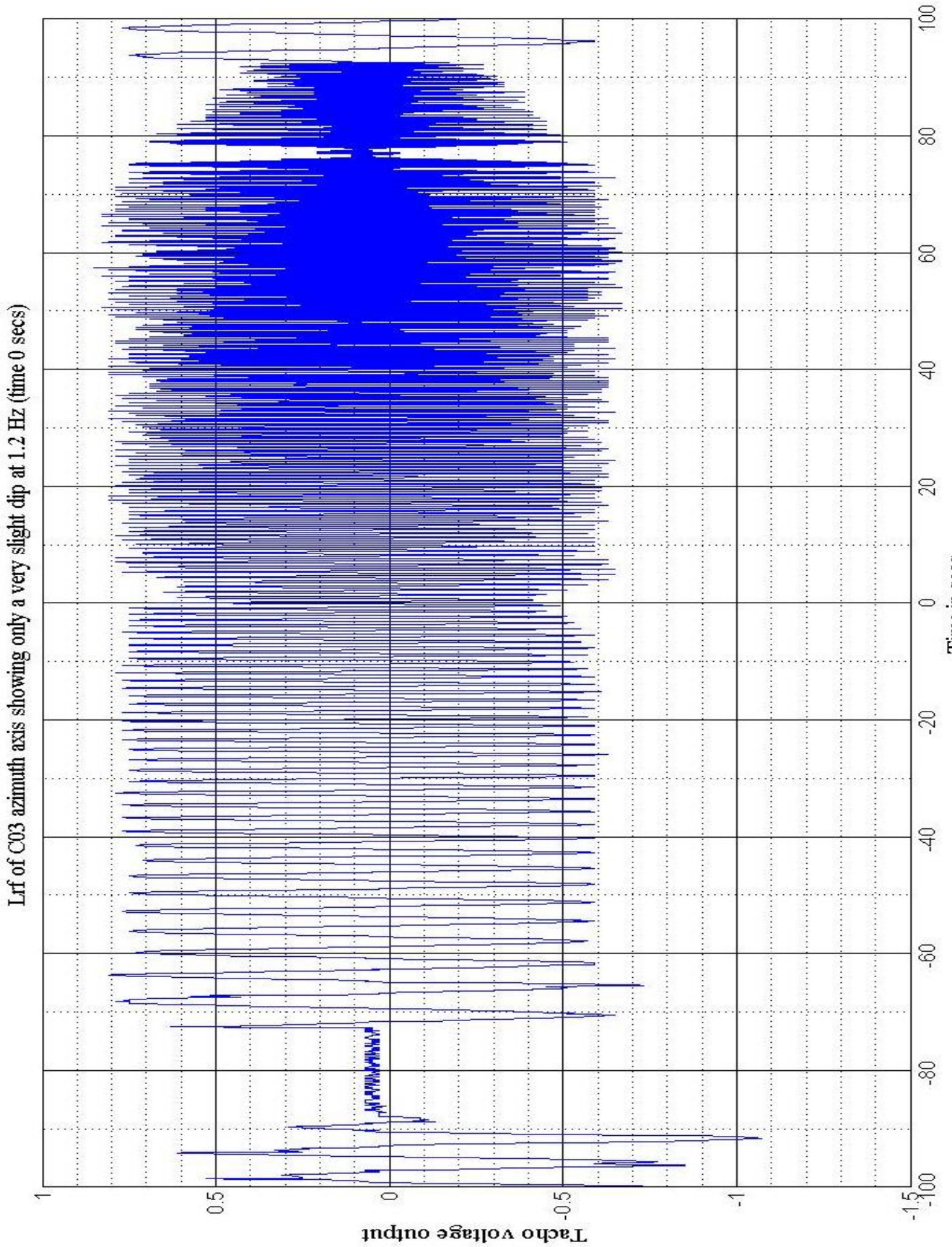

Figure 6: LRF of C03 azimuth axis showing only slight dip at 1.2 Hz