Purpose:

The purpose of this report is to describe a method of orbit rate torquing compensation for use in Module 10 to correct for errors introduced while in eccentric orbits.

Summary:

The method described will correct the pitch attitude error angle, the pitch gimbal angle used in the rendezvous computation and the measured accelerometer outputs and transform them into a corrected local vertical coordinate frame, displaced by an angle $\Delta\theta_p$ from the true platform frame. The time which the platform mode switch is turned to ORB RATE is entered via the MDIU before switching the computer mode switch to RENDZ or CATCHUP. The ground is expected to send via DCS the following parameters prior to entering the RNDZ mode.

e = eccentricity

ω = platform torquing rate

η = mean orbital rate

Discussion:

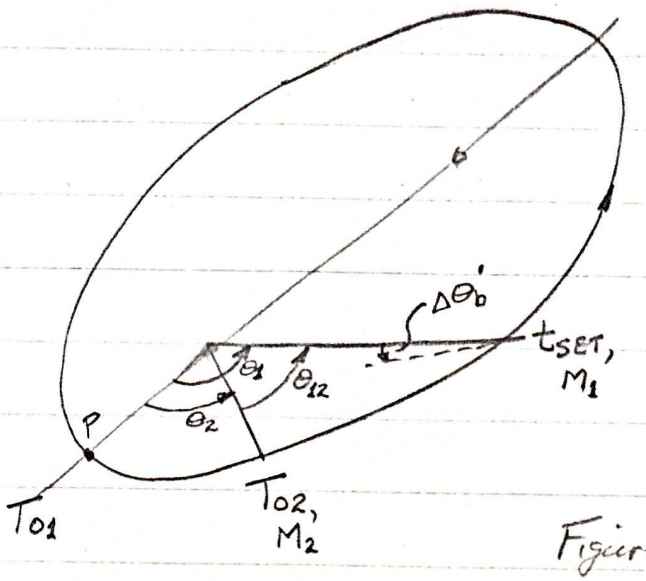

Figure 1

The following equations are to be inserted in the Rendezvous and Catchup computations of Module 3 to arrive at a configuration to be known as Module 10. for the purpose of correcting the orb. rate torquing of the platform.

e = orbit eccentricity
W = platform torquing rate
η = mean orbital rate
} MDIU/DCS loadable

t_{SET} = present Spacecraft elapsed time — MDIU insert and display on same scale as T_{01} & T_{02}

T_{01} = time last at perigee — MDIU/DCS loadable

T_{02} = time platform last switched to ORB RATE mode — MDIU insert & display

M_1 = present mean anomaly at time $t_{SET} = \eta (t_{SET} - T_{01})$

M_2 = mean anomaly at time $T_{02} = \eta (T_{02} - T_{01})$

θ_1 = present true anomaly at time t_{SET}

θ_2 = true anomaly at time T_{02}

The true anomaly will be determined by the truncated series involving mean anomaly and eccentricity:

$$\theta_N = (M_N + 2e \sin M_N) \Big|_{N=1,2}$$

$\theta_{12} = (\theta_1 - \theta_2)$ = difference in true anomaly travelled during last ORB RATE torquing period to present time.

$\Delta\theta_b' = \omega (t_{SET} - T_{02}) - \theta_{12}$ = correction angle applied to computations.

$\theta_b = \theta_b - \Delta\theta_b'$ = corrected pitch gimbal angle

$\Delta\theta_{SC} = \Delta\theta_{SC} - \Delta\theta_b'$ = corrected pitch attitude error angle

$$\left.\begin{aligned} F_x &= F_x \cos \Delta\theta_b' - F_y \sin \Delta\theta_b' \\ F_y &= F_y \sin \Delta\theta_b' + F_y \cos \Delta\theta_b' \\ F_z &= F_z \end{aligned}\right\}$$ corrections to sensed velocity changes.