Plane Change Manoeuvre Problems

Problem No. 01

A **satellite** is in a 322 km altitude **circular orbit**. Find 'ΔV' required to shift **plane** by 5^o, 20^o.

Solution No. 01

The **applicable** velocity impulses are as **follows**.

For 5^o, $\Delta V = 672.9$ m/s,

For 20^o, $\Delta V = 2678.8$ m/s,

Problem No. 02

Determine 'ΔV'**,** if the previous **task** is to be carried out **after** satellite has been placed in **Geo-synchronous** orbit.

Solution No. 02

Solution corresponding to GSO **orbit** is as given below.

For 5^o, $\Delta V = 267.5$ m/s,

For 20^o, $\Delta V = 1065.1$ m/s,

Problem No. 03

A spacecraft is in **6578 km** radius polar **orbit.** Calculate the velocity **impulses** required to **put** it in the **equatorial** plane**,** using direct & **parabolic** change strategies.

Solution No. 03

The **direct** and parabolic manoeuvre **results** are as follows.

Orbital velocity: 7784 m/s

ΔV_{Direct} : 11,008 m/s

$\Delta V_{Parabolic}$: 6,437 m/s

Problem No. 04

A spacecraft is in a **circular orbit** of 552 km altitude. Determine total Δv for an **elliptic** orbit with same perigee and **2208** km altitude apogee with a **10^o plane** change.

Solution No. 04

The **velocity** impulses for the three **cases** are as follows.

Case−1: $\Delta v = \Delta v_1 + \Delta v_2 = 396 + 1391 = 1787$ m/s

Case−2: $\Delta v = \Delta v_1 + \Delta v_2 = 396 + 1123 = 1519$ m/s

Case − 3 : $\Delta v = \sqrt{v_1^2 + v_2^2 - 2 v_1 v_2 \cos 10^o} = 1413$m/s