As mentioned earlier, the homing loop can be used to assess the effect of target maneuvers, initial launch errors, seeker noise, noise filters, & flight control system lags on the miss distance. However, the use of the homing loop to simulate for the above suffers from the following drawbacks.

1) The nominal flight time t_F appears as a parameter in the homing loop. Hence, to analyse how the miss distance varies with the flight time, several simulations have to be carried out.

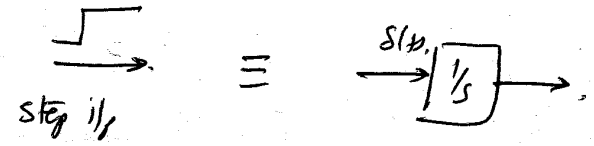
2) To study the effect of individual factors (like target maneuvers, launch errors etc.), different simulations have to be performed, each with one factor operating with the rest being set to zero.

3. Instead, the method of adjoints yields ~~miss~~ ~~individual~~ contributions to the total miss distance from individual factors as a function of flight time in one simulation.

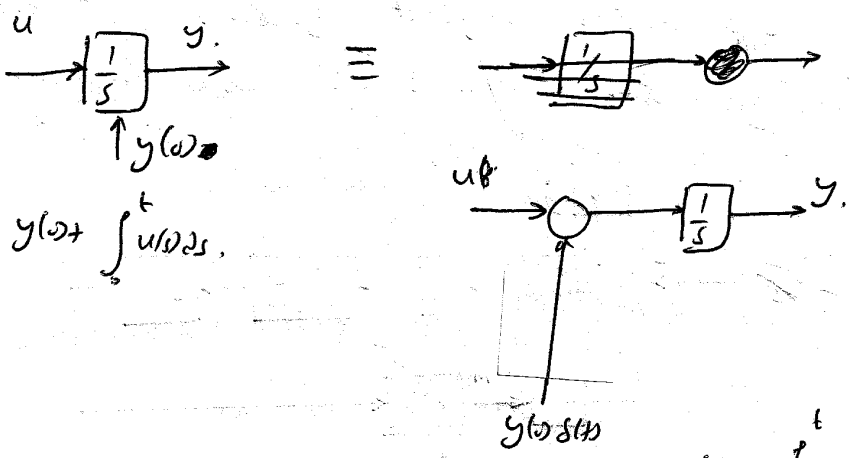
To apply the adjoint method, we have to construct the adjoint of the homing loop.

To construct the adjoint of any linear (time varying or time invariant) system represented as a block diagram, we follow the following steps.

1). In the original block diagram, write all inputs as impulse responses of ~~system~~ suitable systems.

e.g. 

2) Similarly, write all initial conditions as integrals of impulse functions.

e.g. 

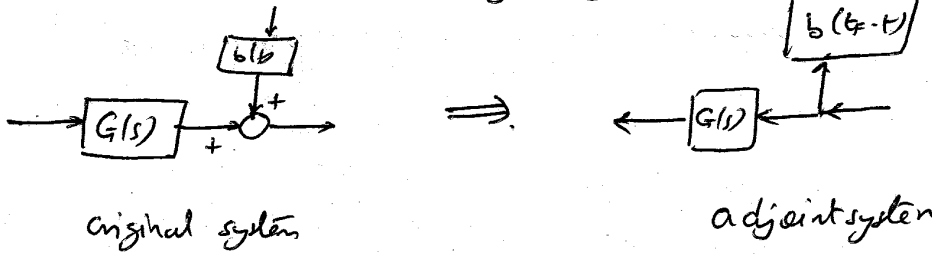
$$y = y(0) + \int_0^t u(s)\,ds.$$

$$y(t) = \int_0^t u(s)\,ds + \int_0^t y(0)\,\delta(s)\,ds$$

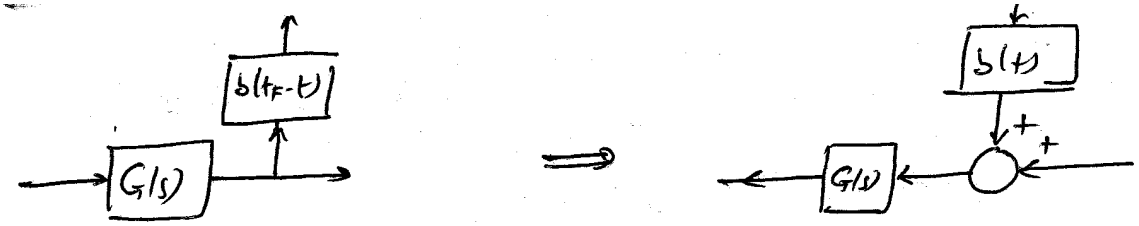
$$= y(0) + \int_0^t u(s)\,ds.$$

2). Replace t by $t_F - t$ in all time-varying terms.

3) Reverse all arrows, replacing junctions by summing junctions & summing junctions by junctions. (Note: redraw all summing junctions with '+' signs at all incoming signals).

e.g. 

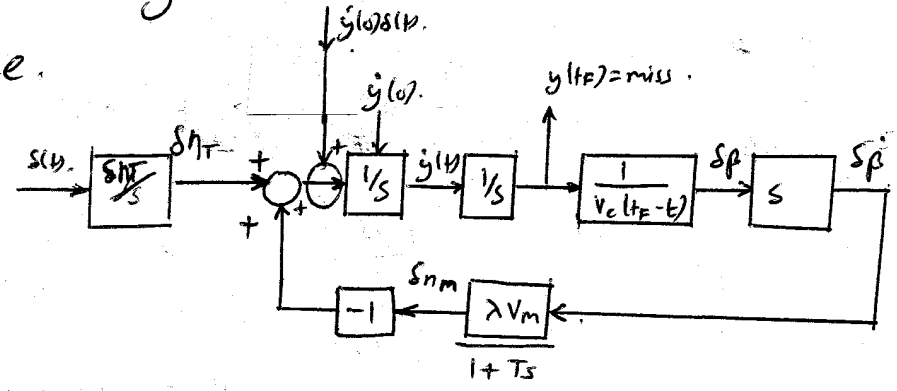
original system adjoint system.



original system

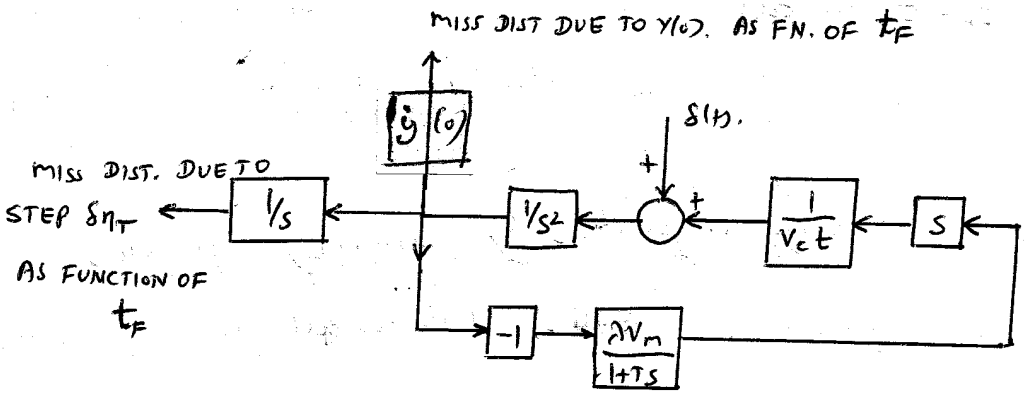
adjoint system.

4) After step 3, all o/p in the original system became i/p in the adjoint system. Apply impulse functions at these inputs. All i/p in the original system have become o/p in the adjoint system. The response at these outputs give the miss distance as a function of the flight time.



Eg.

HOMING LOOP WITH FCS LAG.



ADJOINT OF HOMING LOOP WITH FCS LAG