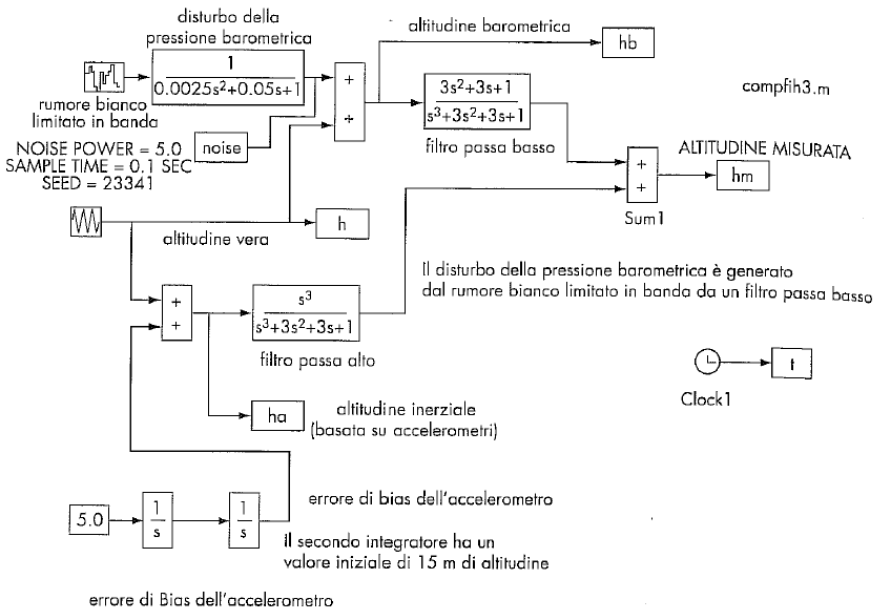
Work in class on COMPLEMETARY FILTERING

1. Build the Simulink sheme as in the following figure applying a FIRST order complementary filtering. NOTE: write the filter in extended mode (i.e. with integrators blocks), nota s a transfer function.

FIGURA 9.23
Altimetro baroinerziale più realistico.



2. Insert a 3° order filter as written below. Evaluate the relation between the cutting frequency and the response transitory (i.e. convergence speed). Use the matlab script to launch also the Simulink simulation (i.e. using the command sim('…')).

```
ft = 0.1;
[B,A] = butter(3, ft, 'high','s')  % con 's' si definisce il filtro analogico (funzione di s)
% A è il denominatore, B il numeratore

% per la creazione di un filtro analogico
Ah = A;
Al = A;

Bh = A;
Bh(2:4) = 0;

Bl = A(2:4);
% PROVARE A 'TRAVASARE TERMINI AL NUMERATORE
% DAL FILTRO PASSA ALTO AL PASSA BASSO E VICEVERSA
%%%%%%%%%%%%%%%%%%%%%%%

SYShigh = tf(Bh,Ah)  % mostra le funzioni di trasferimento
SYSlow = tf(Bl,Al)

bode(SYShigh,SYSlow,{1e-6,1e6})  % le plotta nel diagramma di Bode
grid on
figure, bode(SYShigh+SYSlow,{1e-4,1e4})  % plotta la somma delle due
```

```
sim('AltBaroInerzialeF6ord')
% plotta risultato della simulazione
figure, plot(t,zv,t,za,t,zb,t,zm)
grid on, zoom on
legend('True height','accelerometers height',...
   'barometric height','Fused height with complementary filter')
```

3. Insert a first order system with t = 0.3s in the pitot tube chain to simulate the filtering effect of the tube. Leave the disturbance simulated with the shaping filter summed (i.e. without filtering).

4. Insert a dynamic compensation in the pitot tube chain before complementary filtering

5. Try to increase the complementary filter order