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function means_filtered = DKF_filtering(means, vars, A, G, VZ)
%DKF_FILTERING filters under the DKF model:
% hidden(t)|observed(t) ~ N(means, vars)
% hidden(t)|hidden(t-1) ~ N(A*hidden(t-1), G)
% hidden(t) ~ N(0, VZ)
% this function returns the estimates:
% hidden(t)|observed(1:t-1) ~ N(means_filtered, vars_filtered)
% means are [n,T] dimensional
% vars are [n,n,T] dimensional

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[n,T] = size(means);
means_filtered = zeros([n,T]);

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S = vars(:,:,1);
nu = means(:,1);
means_filtered(:,1) = nu;

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for t = 2:T
    aa = means(:,t);
    bb = vars(:,:,t);
    if ~all(eig(inv(bb)-inv(VZ))>0)
        bb = inv(inv(bb)+inv(VZ));
    end
    Mi = pinv(G+A*S*A');
    S = pinv(pinv(bb)+Mi-pinv(VZ));
    nu = S*(bb\aa+Mi*(A*nu));
    means_filtered(:,t) = nu;
end

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end

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end

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