

```

%   If uu = 0 then P = I
%
n = size(v,1);
if v(i:n) == zeros(n - i + 1,1)
    P = eye(n);
else
    PP = eye(n - i + 1) - 2*v(i:n)*v(i:n)';
    P = [eye(i-1) zeros(i-1, n - i + 1); zeros(n - i + 1, i - 1) PP];
end
end

```

The function `Hessenberg1` computes an upper Hessenberg matrix H and an orthogonal matrix Q such that $A = Q^T H Q$.

```

function [H, Q] = Hessenberg1(A)
%
%   This function constructs an upper Hessenberg
%   matrix H and an orthogonal matrix Q such that
%   A = Q' H Q
%
n = size(A,1);
H = A;
Q = eye(n);
for i = 1:n-2
    % H(i+1:n,i)
    [~,u] = house(H(i+1:n,i));
    % u
    P = buildhouse(u,1);
    Q(i+1:n,i:n) = P*Q(i+1:n,i:n);
    H(i+1:n,i:n) = H(i+1:n,i:n) - 2*u*(u')*H(i+1:n,i:n);
    H(1:n,i+1:n) = H(1:n,i+1:n) - 2*H(1:n,i+1:n)*u*(u');
end
end

```

Example 18.2. If

$$A = \begin{pmatrix} 1 & 2 & 3 & 4 \\ 2 & 3 & 4 & 5 \\ 3 & 4 & 5 & 6 \\ 4 & 5 & 6 & 7 \end{pmatrix},$$