MATH 5110 – Applied Linear Algebra and Matrix Analysis

❖ Inner Product Space

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Matlab code for orthogonal projection

Here's an example MATLAB code that demonstrates orthogonal projection:

```
% Define the vector to be projected
v = [1; 2; 3];

% Define the projection matrix
A = [1, 0, 0;
     0, 1, 0];

% Calculate the orthogonal projection
projection = A * ((A' * A) \ (A' * v));

% Display the result
disp('Orthogonal Projection:');
disp(projection);
```

If you want to perform an orthogonal projection onto an arbitrary basis, you can use the Gram-Schmidt process to orthogonalize the basis vectors.

```
% Define the vector to be projected
v = [1; 2; 3];

% Define the basis vectors
u1 = [1; 1; 0];
u2 = [1; -1; 1];

% Apply Gram-Schmidt process to orthogonalize the basis vectors
w1 = u1 / norm(u1);
w2 = u2 - dot(u2, w1) * w1;
w2 = w2 / norm(w2);

% Calculate the coefficients of the projection
coefficients = [dot(v, w1); dot(v, w2)];

% Calculate the orthogonal projection
projection = w1 * coefficients(1) + w2 * coefficients(2);

% Display the result
disp('Orthogonal Projection:');
disp(projection);
```

If you want to perform an orthogonal projection onto an **orthonormal** basis,

```
% Define the vector to be projected
v = [1; 2; 3];

% Define the subspace basis vectors
u1 = [1; 0; 0];
u2 = [0; 1; 0];

% Calculate the coefficients of the projection
coefficients = [dot(v, u1); dot(v, u2)];

% Calculate the orthogonal projection
projection = u1 * coefficients(1) + u2 * coefficients(2);

% Display the result
disp('Orthogonal Projection:');
disp(projection);
```