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function fespace = FiniteElementSpace(mesh,order)
% $Author : Vignesh Ramakrishnan$
% $RIN : 662028006$ $Date : November 21, 2021$
% $Code Version: 1.0$
% This function is used to generate the Finite Element Space for order 1
% polynomials. Higher order polynomials cant be handled in this code.
% Inputs : mesh - structure mesh which holds all mesh information generated
%           using generateRecMesh function
%           order - order of polynomial used for Finite Elements
% Outputs: fespace - structure
%           fespace.Element - Holds Element ID
%           fespace.ElemDOF - 1D array which holds the DOF of the nodes
%                           attached to the element
%           fespace.ElemGrid- 2D array which holds the GridLocation of the
%                           nodes attached to the element
% this code considers only rectangular elements
% if order is increased, it will add more nodes to the mesh.
[m,n] = size(mesh.DOF);
Nodes = mesh.num_node;
k = 1;
for i=1:m-1
    for j=1:n-1
        LocalDOF(1,1) = mesh.DOF(i,j);
        LocalDOF(2,1) = mesh.DOF(i,j+1);
        LocalDOF(3,1) = mesh.DOF(i+1,j);
        LocalDOF(4,1) = mesh.DOF(i+1,j+1);

        LocalGridFn{1,1} = mesh.GridFn{i,j};
        LocalGridFn{2,1} = mesh.GridFn{i,j+1};
        LocalGridFn{3,1} = mesh.GridFn{i+1,j};
        LocalGridFn{4,1} = mesh.GridFn{i+1,j+1};
        [locNodes,extraNodes] = AccuElemNodeData(LocalGridFn,order,Nodes);
        Nodes = Nodes + extraNodes;

        fespace(k).Element = k;
        fespace(k).ElemDOF = [LocalDOF;locNodes.locDOF];

        fespace(k).ElemGrid = [LocalGridFn;locNodes.pt];
        k = k + 1;
    end
end
end

```

