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function [FE_space] = FiniteElementSpace(mesh,order)
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% $Code Version: 1.0$
% This function is used to generate the Finite Element Space assigning each
% element with its corresponding nodal DOF and spatial grid function
% Inputs : mesh      : An input structure of the mesh information of domain
%           order     : The order of interpolating polynomials to generate
% Output : FE_space  : A structure that contains the DOF and GridFn
%                   information for each element in the mesh with added
%                   node points based on the polynomial order required
%           ElemDOF   : Array containing the DOF of each node in the element
%           LocDOF    : Cell containing location of the DOF in space

Nelem = mesh.num_elem;

% FE_space stores the following:
% Element ID
% DOF attached to Element ID (ElemDOF)
k = 1;
for i=1:Nelem
    FE_space(i).ID = i;
    t = zeros(order+1,1);
    for j=1:order+1
        t(j,1) = k+j-1;
    end
    FE_space(i).ElemDOF = t; k = k+order;
    int_pt = ComputeIntGridPt(mesh.GridFn{i},mesh.GridFn{i+1},order);
    FE_space(i).LocDOF = [mesh.GridFn{i};int_pt;mesh.GridFn{i+1}];
end

end

```

