ACKNOWLEDGMENTS

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CHAPTER 1

747, born in the late 1960’s, was a tangible by-product of extended FEM analysis [6]. By the of the middle 1970’s, FEM had matured mathematically and reached a decent punch” (RFP) problem. Much work was imparted into the development of the mesh for the RFP problem, and experimentation revealed that result accuracy is highly

CHAPTER 2

Preliminaries

1. $\bar{\boldsymbol{\Omega}} = \square_{\mathbf{i}=1}^{\mathbf{p}} \bar{\boldsymbol{\Omega}}_{\mathbf{i}}$

Since

$$a_2(w,w) = -\int_0^1 (w''(x))^2 dx, \qquad (2.9)$$

function w

vector field in a three-dimensional domain with a chosen coordinate system may be represented by a triplet of functions, and a tensor field by a 3×3 matrix function. The

CHAPTER 3

Finite Element Method

The process of solving a problem using the FEM can be broken down into five steps.

1. Identify and represent the physical system – usually through the construction of linear or nonlinear partial differential equations, and corresponding weak variational formaations

3.1 Approximation Techniques

Emphasis will be placed on one specific approximation technique called the

The unknown constant a from the trial function must be tuned to help u represent the true solution as accurately as possible. Introduce a

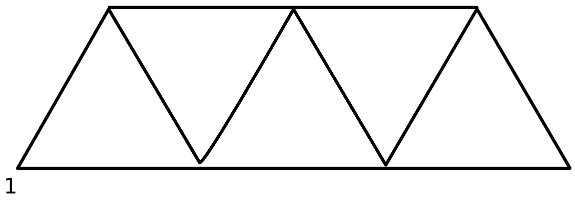
where

$$H_1(x) = \frac{x_{i+1} - x}{l},$$

$$H_2(x) = \frac{x - x_i}{l}.$$

The weighting functions, w_1 = H_1(

After defining the length of the spring as $l = u_2 - u_1$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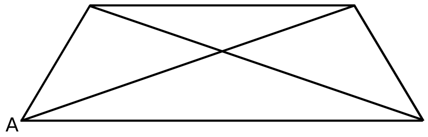
4.1 General Mesh Formulation

The basic goal of meshing is to divide some region of interest

-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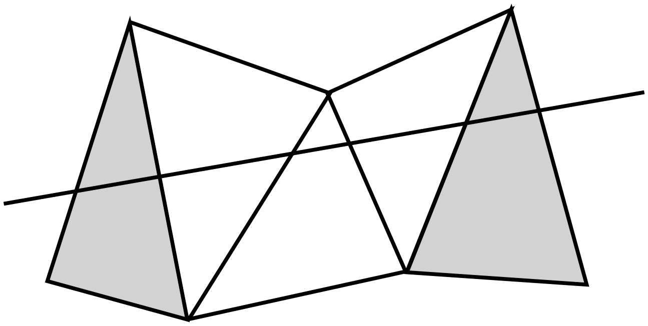
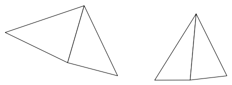


The so-called



Claim. The area S

Equivalent expressions for for $N_j(x, y)$ and $N_k(x, y)$ are obtained through obvious permutations of the indices.

Each velocity jump in (5.7) is the vector difference of the velocities of two

with which to contend. Given two triangles n and m with vertices ijk and ilj that share an edge ij

CHAPTER 6

Linear Programming

The total power problem then becomes one of minimizing

$$Z$$

the derivation of equation (5.28). The shared edge passed into the function as an argument contains two of the nodes of each triangle. These become nodes i and j. The third node, k

APPENDIX A

MATLAB Source Code

A.1 Distance from a Point to a Line

```
function d = dpointline(line, p)

```

```

% Use desegment (unsigned) combined with sign from
% relative placement.
d = d + cond1 .* -dsegment(p, line);
d = d + cond2 .* dsegment(p, line);
```

A.2 Distance tonn

```
% Normalize the distances to span 0 to 1
distN = (dist - minD) * (1 / maxD);
```

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```

% Finally, crop down both output matrices to the correct length
edges   = edges(1:nEdges - 1, :);
tEdges  = tEdges(1:nEdges - 1, :);
```

```
end

% For convenience, assign values for each node in the paralellagram
% formed by the two conjoined triangles.
ni          = nodes(dP(1, 1), :);
nj          = nodes(dP(2, 1), :);
if nTri1 ~= 0
    nk      = nodes(dP(3, 1), :);
end
if nTri2 ~= 0
    nl      = nodes(dP(4, 1), :);
end

% Compute the power with respect to each nodal value.
dP(1, 2)    =  area1 * (dX * (nk(1) - nj(1)) + dY * (nk(2) - nj(2)))  ...
             - area2 * (dX * (nj(1) - nl(1)) + dY * (nj(2) - nl(2)));
dP(2, 2)    =  area1 * (dX * (ni(1) - nk(1)) + dY * (ni(2) - nk(2)))  ...
             - area2 * (dX * (nl(1) - ni(1)) + dY * (nl(2) - ni(2)));
dP(3, 2)    =  area1 * (dX * (nj(1) - ni(1)) + dY * (nj(2) - ni(2)));
dP(4, 2)    =  area2 * (dX * (ni(1) - nj(1)) + dY * (ni(2) - nj(2)));
```

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```
    nodesTerm = ’’;         % Holds unknown nodal value terms

    % Build the unknown nodal value terms. Each term is added if

```

References

[12] Makhorin, Andrew.