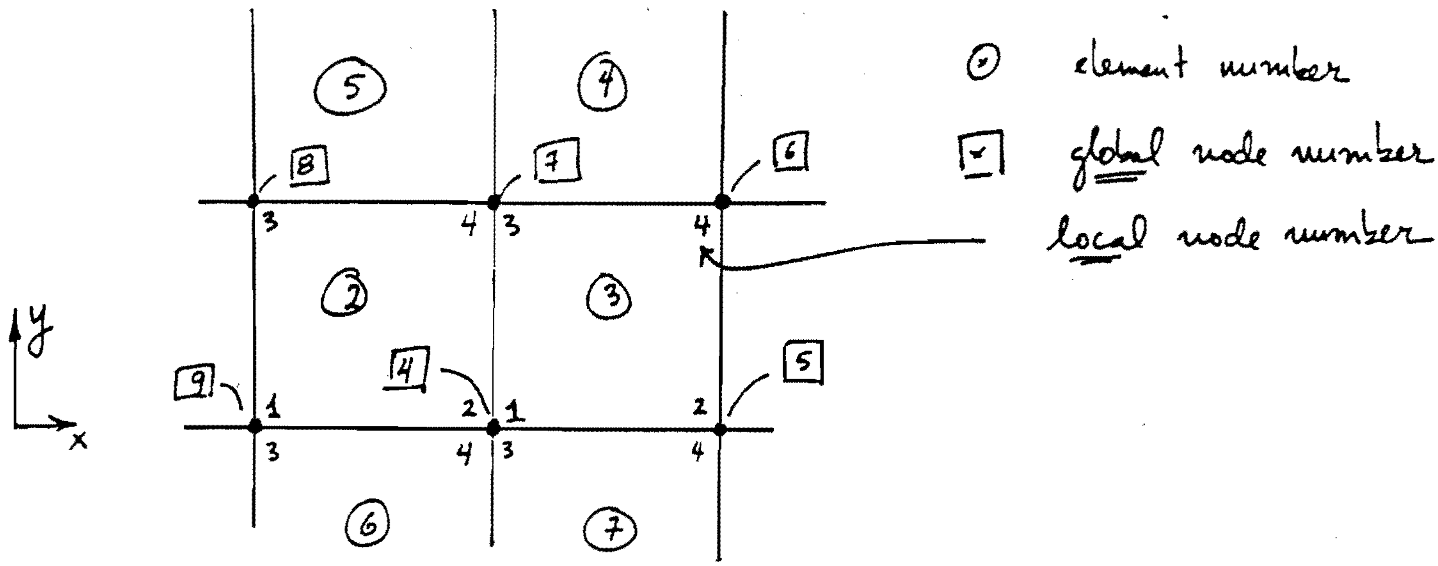
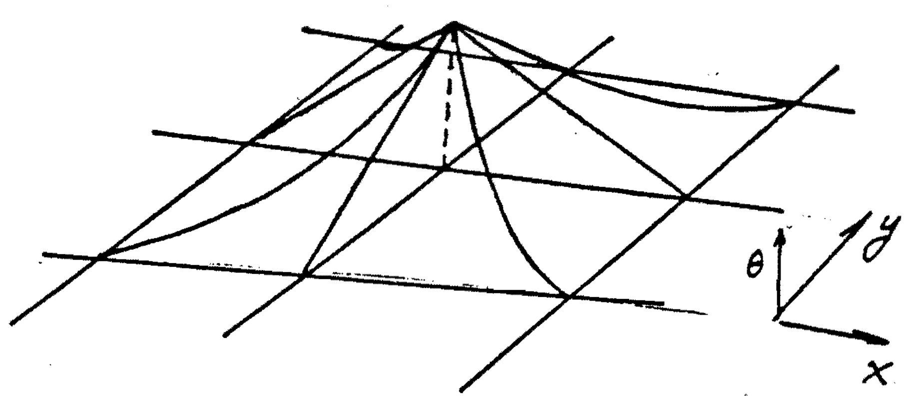
(50)

4. Assembly Procedure



Direct stiffness: we require $\delta\Pi = 0$ for arbitrary variations in $\delta\theta_{\boxed{4}}$ (say) $\Rightarrow$ we must sum all the contributions to $\delta\Pi$ due to $\delta\theta_{\boxed{4}}$ ($\delta\theta_4^6$, $\delta\theta_3^7$, $\delta\theta_2^2$, $\delta\theta_1^3$) and set them to zero. In other words, our actual basis functions are 2-D witch-hats



To mechanize the procedure we require a local → global "mapping" for the node numbers :

g_i^k : global node # of i^{th} local node in element k

For instance

$g_1^2 = 9$, $g_2^2 = 4$, $g_3^2 = 8$, $g_4^2 = 7$

$g_1^3 = 4$, $g_2^3 = 5$, $g_3^3 = \ldots$

Given these g_i^k we can succintly write down the assembly procedure in Fortranesque form:

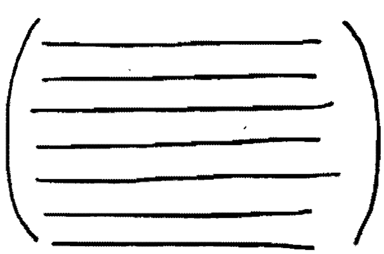
set $A(\cdot,\cdot) = 0$

no superscript ⇒ system matrix

```
      do 1  k = 1, # of elements
      do 1  i = 1, 4        (eqn. due to variation δθ_i^k)
      do 1  j = 1, 4        (in terms of θ_j^k)
          A(g_i^k, g_j^k) = A(g_i^k, g_j^k) + A^k(i,j)
1     continue
```

direct stiffness

Note this stores A in regular format



in practice it is stored in banded format, and only half is stored (A is always symmetric)