
Algorithm 2 Calculate deformation input to constitutive model and update material state to Q^n

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1: procedure CALCULATE DEFORMATION INPUT TO CONSTITUTIVE MODEL AND UPDATE  
   MATERIAL STATE TO  $Q^n$   
2:   for Each Element do  
3:     Gather nodal degrees of degrees of freedom for total/inc displacement  
4:     for Each quadrature point do  
5:       Calculate gradient for total/inc displacement (mat-mult operations)  
6:       Calculate gradient for the force ( $3 \times 3$  matrix local operations)  
7:       Incremental kinematic step  
8:       Constitutive update step  
9:       Accumulate quadraure step  
10:    end for  
11:    Scatter nodal degrees of freedom to force vector  
12:  end for  
13: end procedure
```
