**1 MEMBER END RELEASE**

Considering a local coordinate system, the stiffness relation can be written as:



where,

: end-force vector

: stiffness matrix

: end-displacement vector

: fixed end-force vector

A release for displacement k means that this displacement will be a value such that the corresponding component of the end-force vector is nullified.







The i component of vector f, can be written as:



Substituting the expression for the released displacement into the previous equation, the modified stiffness relation follows:



The stiffness components are modified according:



Note that the previous expression results zero when evaluated for i = k or j = k.



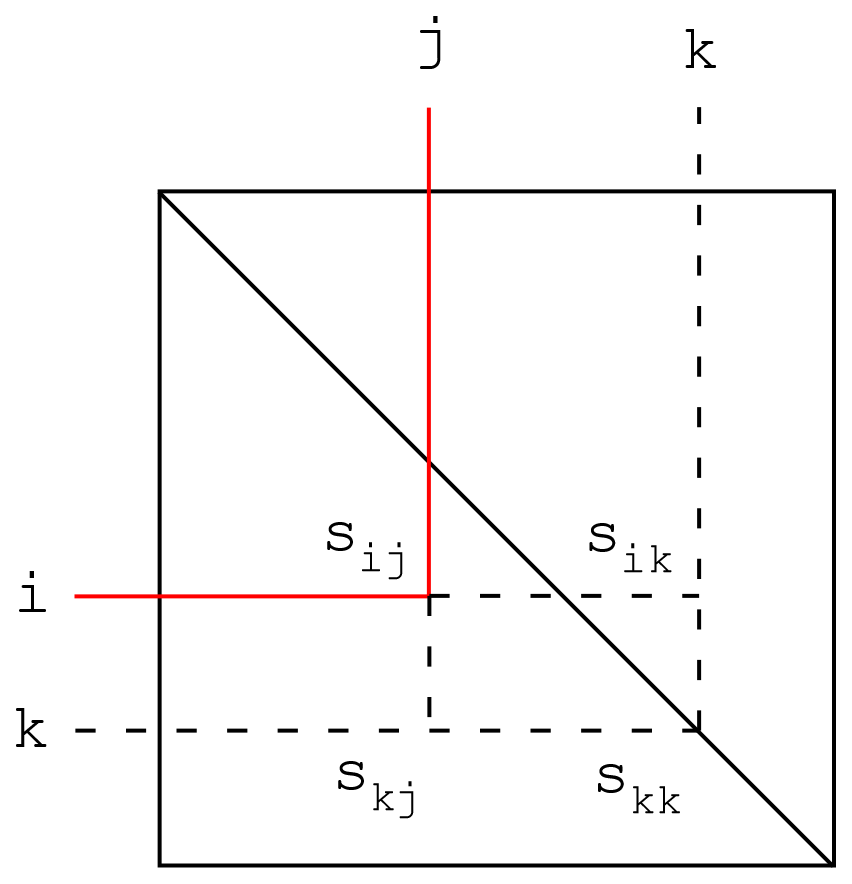


Therefore, the modified stiffness relation can be written including the released displacement as:



The corresponding stiffness components are modified according:





The fixed end-force components are modified according:



**1.1 Stiffness relation**









A release for displacement sub-vector means that this displacement sub-vector will be a vector such that the corresponding sub-vector of the end-force vector is nullified.





**1.2 Potential energy**





Substituting the expression for the released displacement sub-vector into the previous equation, the modified potential strain energy follows:



**1.3 Gradient of potential energy**



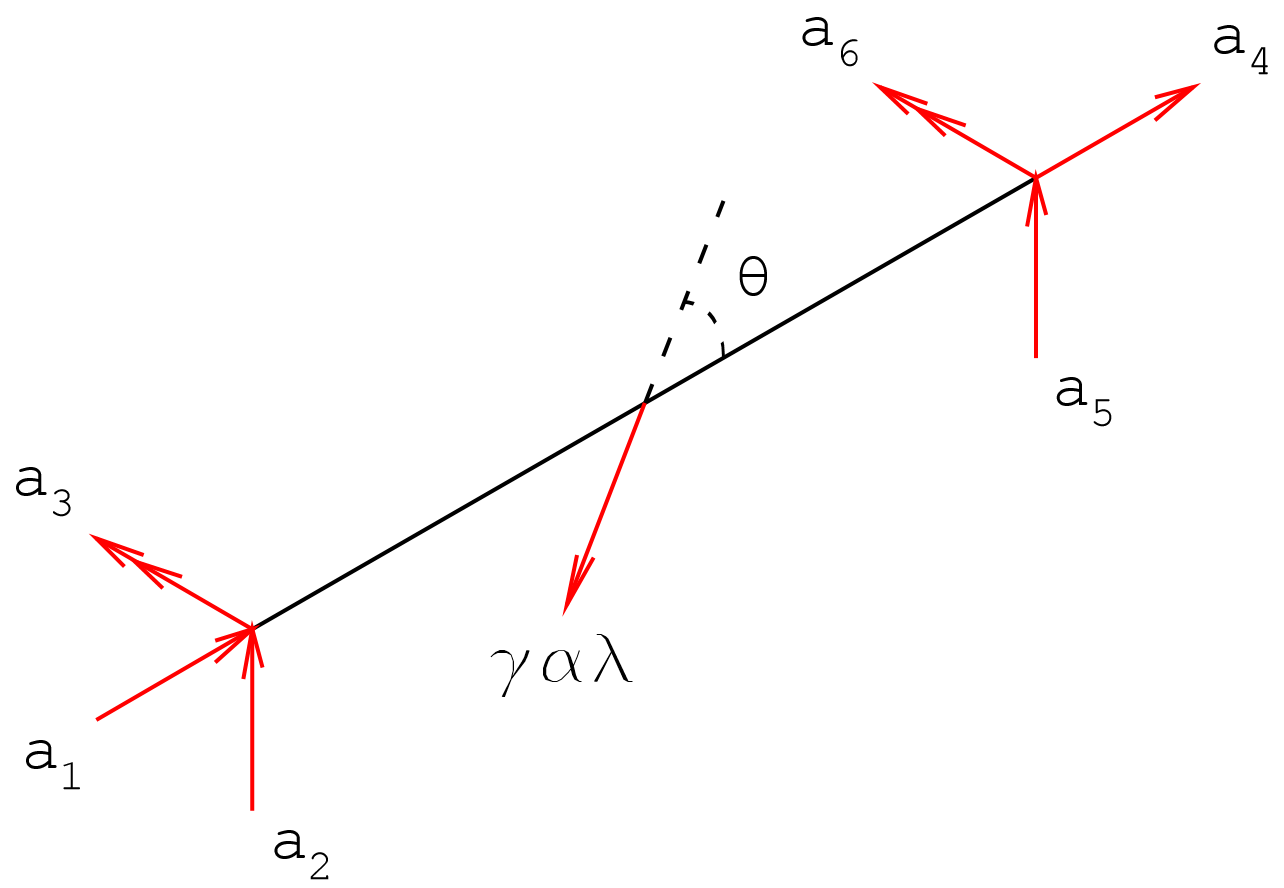


**2 NODAL ACTIONS DUE TO SELF WEIGHT**

: weight/volume

: area

: length

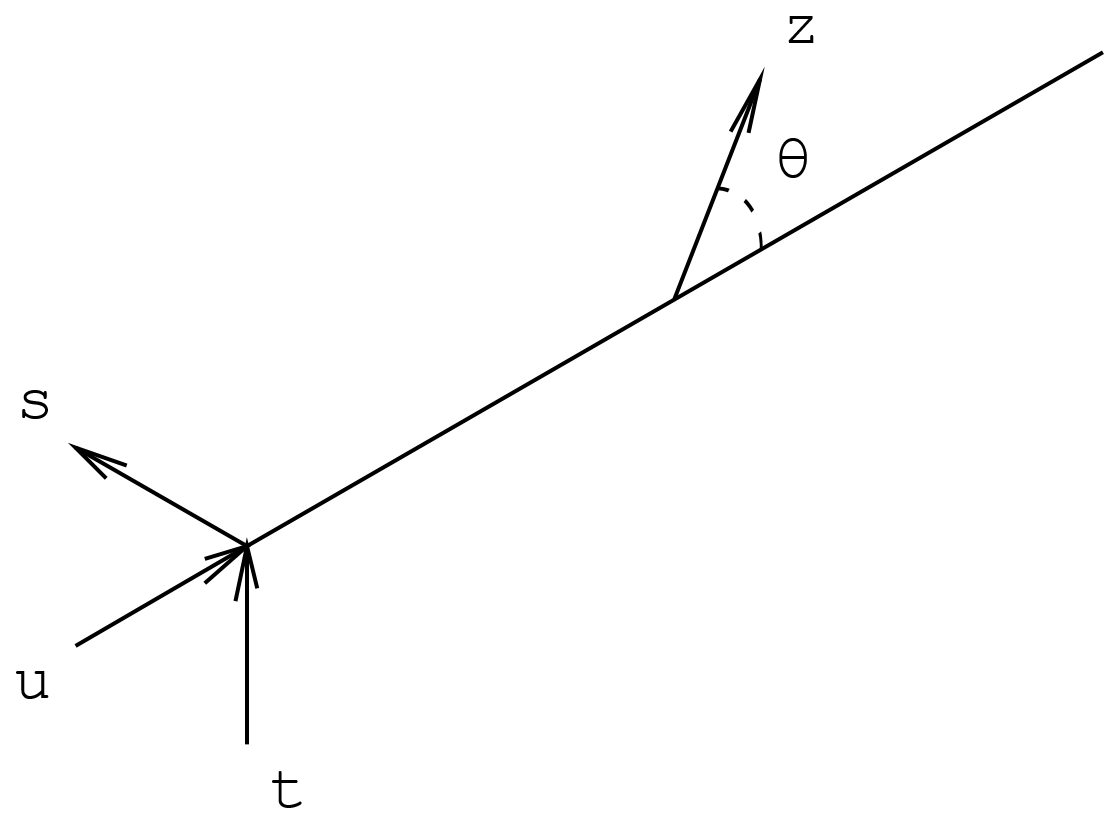


























**2.1 Nodal action (force) at node 1**



**2.2 Nodal action (moment) at node 1**

