equations, and ~~they~~ give the same results. The purpose of this chapter is more to present the application of the Modified Newmark Method rather than the discussion of the methods of the frame analysis. Therefore, the equilibrium method is only discussed here~~.~~. Both ~~of~~ procedures provide three linear equations for each node. Therefore, the number of the equations for the whole of a structure is equal to:

$$NEq = 6NE + 3NN \tag{4}$$

There ~~is~~are a balanced number of unknowns and equations and therefore, the new coefficients of integrals and the generalized nodal displacements can be computed in each stage of the iteration.
It is worth noting that ~~the~~ both sets of linear equations are not simultaneous, thus the number of simultaneous equations to be solved can be reduced. The first set of equations can be applied firstly to define a relationship between the new integral coefficients and the generalized nodal displacements. Then this relationship can be enforced to the second set of equations to introduce a system of simultaneous linear equations with 3NN equations. Therefore, the next steps are:
11- Calculating ~~the~~ nodal displacements of all nodes.
12- Calculating ~~the~~ new coefficients at each stage of the iterations including the initial one.
13- Performing steps (11 and 12) until the set of solutions fall inside the required tolerance and the method converges. However, as explained through this dissertation, the matrix coefficients during the structural analysis using the established method remains unchanged and can be stored and ~~utilised~~utilized in all stages of the iterations.

2.2. FORMULATION OF AN ELEMENT

In this ~~section~~section, the ~~behaviour~~behavior of an element of a frame is treated by considering geometrical non-linear problems. An arbitrary element of a frame is shown in Fig~~ure~~.ure (1) with its local and global co-ordinates. The generalized end displacements at both ends show all possible movements of the element for the in-plane analysis. Here it is assumed that the method has a constant flexural rigidity and axial load over each element. The governing differential equations for the j-th element are expressed in ~~Eqns~~ Eq. (1). ~~Eqn (1)~~This equation is a simple integral equation and its solution can be obtained by twice integrating. The constant coefficients of the integrals can be determined by enforcing the generalized ~~displacements is~~displacement in the x direction $(d_{1,j}, d_{4,j})$. Since each element of a frame is connected to the adjacent elements, its generalized displacement will be changed during the process of the solution. Hence, the constant coefficients of the integral for the axial deflection "x" must be determined in each stage of the iteration. In other words, the axial deflections of the elements will influence the solution of the frames as an assemblage ~~structures~~ structures. ~~Eqn~~Eq. (1) is a linear differential equation that can be solved by the Modified Newmark Method. This solution for different types of problems and end conditions was solved in the previous chapters. Its equivalent integral equation for the iterations is shown in chapter four. The integral equations for both ~~Eqns~~ Eq. (1) are again rewritten ~~here,~~ as:

$$(x_i)_j = \iint dx\,dx \qquad (y_i)_j = \frac{1}{EI_j}\iint\iint\left(N_j (y_{i-1})_j + q_j\right) dx\,dx\,dx\,dx \tag{5}$$

The initial arbitrary solutions must be defined in both directions of displacement. As explained in the chapter three, these solutions are chosen from polynomials whose order must be determined from the boundary condition requirements. Obviously, the generalized displacements are the boundary conditions for these differential equations. Since the initial deflections are:

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