In the present investigation, the effect of imperfections such as cracks and initial
crookedness as well as that due to non-linearities on the stability of beam-columns have
been considered. In order to examine the effect of cracks on stability of beam-columns, an
expression for the local stiffness due to an edge crack in a rectangular beam-column was
derived. The non-dimensional crack stiffness $K^*$ was the used to derive expressions for
reduced stability loads in imperfect beam-columns using Liapunov’s direct method. A similar
expression for calculation of reduced stability loads in imperfect beam-columns was derived
using matrix displacement method of analysis. As the method of matrix displacement
method of analysis proposed herein depends on prior knowledge of crack point
displacements, a finite element stress analysis was carried out to obtain the required crack-
point displacements and also to examine the stress variations in the pre-cracked and
uncracked beam-column models i.e. pin-pin and cantilever beam-column models. A finite
element computer program CNODE. FOR which is a stress analysis program was developed
using the Constant Strain Triangle (CST) element. Beam-column models without edge cracks
were first examined using the stress analysis program. Then cracks were introduced and the
program was run again. Results were obtained and both crack displacements as well as
variation in stresses due to the presence of edge cracks were studied in details.
Non-linear effects were also examined. First of all element stiffness matrices were derived
using existing formulations for non-linear structural analysis and the present formulation
and the two were compared. In each of the formulations used, the second order non-linear
element stiffness matrix $N2$ depends on the square of the slope. To obtain the slope, a large
displacement or non-linear analysis using predictor-corrector method was carried out. The
result of the PREDICTER-CORRECTOR analysis was later used to complete the element
stiffness matrix $N2$ and hence form the stability equations. The stability equations were
solved on the program NLSTAB.FOR developed for that purpose, to obtain stability loads. A
linear stability analysis was also carried out to show that linear stability analysis is a special
case of non-linear stability analysis. The linear stability equations were solved using another
program LSTAB2.FOR which was developed for the purpose for linear stability analysis. Both results of non-linear and linear stability analyses obtained were then discussed. The effect of initial crookedness was also examined using Perry-Robertson equation which has hitherto been used only for axially loaded columns. However, due to beam-column effects, the Perry-Robertson's equation was modified to include effects due to transverse loads, cracks as well as non-linearities. The combined effects of cracks, initial crookedness and non-linearities on stability of imperfect beam-columns were finally examined and conclusions made.

Finally, all the computer programs mentioned above were developed and tested by the present investigator using fortran 77 or WATFOR 77 compiler.