

## INVESTIGATION OF ELASTIC SHORT – TERM STABILITY OF REINFORCED AND COMPOSIT CONCRETE STRUTS BY MODIFIED NEWMARK METHOD

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### ABSTRACT

The aim of this Paper is to treat the “elastic” stability of reinforced and composite concrete struts. The object of this study is to verify the ability of the Modified Newmark Method to include geometric non-linearity in addition to the non-linearity due to cracking, and also to show the advantage of the established method to reconsider an ignored minor parameter in mathematical modelling, such as the effect of the cracking by extra geometric bending moment ( $N_y$ ) on cross-section properties. The purpose of this investigation is not to present some new results for the instability of reinforced or composite concrete columns. Therefore, all kinds of non-linearities involved in the problem are not considered here. Only as mentioned, it is a part of the verification of the new established method to solve two kinds of non-linearities ( $P - \delta$  effect and cracking) together simultaneously. However, the Modified Newmark Method can be used to solve the non-linearity of materials and the time-dependent behaviour of concrete. But since it is out of the scope of this dissertation, it is not considered here, and the review given in the previous section was merely for the interest of the reader.

**Key Words:** Stability, Buckling, Modified Newmark Method, Reinforced

### 1 INTRODUCTION

The stability problem of slender reinforced concrete elements has only been studied and understood thoroughly through the use of computers. For this reason, the early regulations prior to 1960 are inadequate, when assessed from today’s standpoint. The effect of buckling of axially loaded reinforced concrete elements was taken into account by increasing the axial load at the beginning, and at the next stage was to use magnifiers on the moment alone. Since the developed cracking zone is changed through the length of the elements, this bending stiffness is variable and it depends on the shape of cross-section, ratio of reinforcement, loading and the extra deflection caused by buckling. For this reason, the stability of reinforced concrete struts needs special treatment, even if the materials remain linear elastic. Until now, no general analytical solution has been developed for the stability problem of reinforced concrete beam-columns under different end and loading conditions. The difficulty is caused by the inability to obtain differential equations due to non-linearity of the flexural rigidity caused by the effect of cracking. But by applying the Modified Newmark Method, the differential equations can be simplified to the linear ones and then during the iteration procedure this simplification is modified by the former solution.