NONLINEAR BEHAVIOR OF MULTISTORY STEEL BUILDINGS USING ITERATIVE APPROACH

A Directed Study
Presented to the
Faculty of Graduate School of Engineering of the
Pamantasan ng Lungsod ng Maynila
(University of the City of Manila)

In Partial Fulfillment of the Requirements
For the Degree
Master of Engineering (MEng)
with Specialization in
Structural Engineering

By

MARCELINO A. DAGASDAS, Jr.

03 FEBRUARY 2001

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ABSTRACT

The built-in capability of STAAD-III to perform nonlinear analysis based on the geometric nonlinearity within the elastic limit of the material was presented. The complexity of mathematical expressions involving matrix operation and dynamic equation was simplified by using STAAD - III Nonlinear Analysis Method.

The scope of the problem was limited to nonlinear behavior of multistory steel buildings using iterative approach. The structures was analyzed for combined lateral seismic and vertical loads. All horizontal floor girders were wide flange sections. All columns were W14 sections (Wide Flange) of various weights per foot, which were spliced every two floors. All connections were welded and moment resisting. The seismic analysis was based on existing codes and specifications of NSCP 1992. The Allowable Stress Design (ASD) Method of AISC – 1989 was adopted for analysis, design, checking and optimization of the structural members for nonlinear.

The main objective of this study was to investigate the effects of nonlinear behavior in the multistory steel building which includes the optimization of structural members, comparison of lateral displacement and member forces obtained from conventional analysis.

The study revealed that minimal changes occur and said changes were not significant to the integrity of the overall members of the buildings. Thus, the effect of nonlinear behavior can be neglected because changes in structural members, lateral displacements and member forces were very small.

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INTRODUCTION

1.1 Background of the Study

In all analysis, the structure behaves linearly under applied loads. That is, the computed joint displacements and member end loads are directly proportional to the joints loads. If the loads are doubled, then these quantities also double. This assumption is valid for the majority of the structures encountered in the day-to-day operations of most structural engineering design offices. However, there are some situations in which nonlinear behavior must be considered to obtain a realistic analysis of a structure. There are two primary sources of nonlinearity: First, the change in geometry, which can occur as the loads are applied to the structure. As the load is applied to a joint in a real structure, that joint will move with respect to the members connected to the joint, and the moment, which the load causes about other points in the structure. If the displacements are large enough, the effect, which the loads have upon the structure, can change significantly. Secondly, the nonlinear load-deformation behavior of the individual members will result in a global stiffness matrix, which changes with the magnitude of the applied loads on the structure. One obvious source of this nonlinear behavior is the nonlinear stress – strain relationship of the material. However, this is usually not a common occurrence in the static analysis of the types of the structures encountered in most structural engineering offices (Fleming , 1989).