PROGRESSIVE COLLAPSE ANALYSIS

OF

THIN-PLATED STRUCTURES

USING ISUM

A dissertation
presented to
the faculty of
Department of Civil and Environmental Engineering
Delhi Technological University-Delhi

In Partial Fulfilment
of the Requirements for the Degree
Master of Technology

By
YOGESH KUMAR JANGID
Dr. S.K. Panda and Dr. A.K. Gupta, Dissertation Supervisors
JULY-2013

CERTIFICATE

The undersigned have examined the dissertation entitled

PROGRESSIVE COLLAPSE ANALYSIS

OF

THIN-PLATED STRUCTURES

USING ISUM

presented by Yogesh Kumar Jangid
a candidate for Master of Technology
and hereby certify that in their opinion it is worthy of acceptance

_____

Dr. S.K. Panda

_____

Dr. A.K. Gupta

DECLARATION

I Certify that

a. The work contained in this thesis is original and has been done by me under the guidance of my supervisor.
b. The work has not been submitted to any other Institute for any degree or diploma.
c. I have followed the guidelines provided by the University in preparing the thesis.
d. I have conformed to the norms and guidelines given in the Ethical Code of Conduct of the Institute.
e. Whenever I have used materials (data, theoretical analysis, figures, and text) from other sources, I have given due credit to them by citing them in the text of the thesis and giving their details in the references.

Yogesh Kumar Jangid
(2K11/STE/19)
Department of Civil and Environmental Engineering
Delhi Technological University, Delhi

ACKNOWLEDGEMENT

I would like to sincerely and wholeheartedly thank my advisor Dr. S.K. Panda and Dr. A.K. Gupta for their close guidance, kindness, encouragements, patience, and supervision throughout various stages of the dissertation. Without their help and encouragement, this dissertation would not be possible.

I wish to convey my sincere gratitude to Prof. A.K. Gupta (former H.O.D) and Prof. A. Trivedi (H.O.D.), and all the faculties of Civil Engineering Department, Delhi Technological University who have enlightened me during my project.

Most importantly, I would like thank my parents, for their unconditional support, love, and affection. Their encouragement and endless love made everything easier to achieve.

TABLE OF CONTENTS

LIST OF FIGURES

ABSTRACT

Box columns are often used as main strength members of various types of thin-plated structures such as ships, ship-shaped offshore structures, and aerospace structures. Until and after the ultimate limit state is reached, box columns exhibit highly nonlinear structural behaviour in terms of geometrical and material aspects. In particular, the effects of local buckling, global buckling, and their interaction play a significant role in the resulting consequences of box columns under extreme actions. In order to calculate the maximum load carrying capacity of box columns, it is thus highly required to perform the progressive collapse analysis to take into account progressive failures of individual components and their interacting effects.

The aim of the present study is to investigate the applicability of ISUM to the progressive collapse analysis of box columns which are typical examples of main strength members in land-based structures. Theoretical outline of the method is addressed. Short, medium and long box columns in length are studied in terms of interacting effects between local component failure modes and global system failure modes. A comparison of ISUM with more refined nonlinear finite element method (FEM) computations is also made.