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Dynamic Relaxation Method

Theoretical Analysis, Solved Examples
and Computer Programming



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Dedication

In the name of Allah, the merciful, the compassionate

All praise is due to Allah and blessings and peace is upon his messenger and servant, **Mohammed**, and upon his family and companions and whoever follows his guidance until the day of resurrection.

To the memory of my mother **Khadra Dirar Taha**, my father **Mohammed Elmardi Suleiman**, and my dear aunt **Zaafaran Dirar Taha** who they taught me the greatest value of hard work and encouraged me in all my endeavours.

To my first wife **Nawal Abbas** and my beautiful three daughters **Roa, Rawan** and **Aya** whose love, patience and silence are my shelter whenever it gets hard.

To my second wife **Limya Abdullah** whose love and supplication to Allah were and will always be the momentum that boosts me through the thorny road of research.

To professor **Dr. Mahmoud Yassin Osman** for reviewing and modifying the manuscript before printing process.

This book is dedicated mainly to undergraduate and postgraduate students, especially mechanical and civil engineering students plus mathematicians and mathematics students where most of the applications are of mathematical nature.

To Mr. **Osama Mahmoud** of Daniya Center for printing services whose patience in editing and re – editing the manuscript of this book was the momentum that pushed me in completing successfully the present book.

To my homeland, Sudan, hoping to contribute in its development and superiority.

Finally, may Allah accepts this humble work and i hope that it will be beneficial to its readers

Acknowledgement

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Preface

Chapter one includes introduction to dynamic relaxation method (DR) which is combined with finite differences method (FD) for the sake of solving ordinary and partial differential equations, as a single equation or as a group of differential equations. In this chapter the dynamic relaxation equations are transformed to artificial dynamic space by adding damping and inertia effects. These are then expressed in finite difference form and the solution is obtained through iterations.

In chapter two the procedural steps in solving differential equations using DR method were applied to the system of differential equations (i.e. ordinary and/ or partial differential equations). The DR program performs the following operations: Reads data file; computes fictitious densities; computes velocities and displacements; checks stability of numerical computations; checks convergence of solution; and checks wrong convergence. At the end of this chapter the dynamic relaxation (DR) numerical method coupled with the finite differences discretization technique is used to solve nonlinear ordinary and partial differential equations. Subsequently, a FORTRAN program is developed to generate the numerical results as analytical and/ or exact solutions.

The book is suitable as a textbook for a first course on dynamic relaxation technique in civil and mechanical engineering curricula. It can be used as a reference by engineers and scientists working in industry and academic institutions.

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