



**MARMARA UNIVERSITY**  
**FACULTY OF ENGINEERING**



**OPTIMIZATION OF SPACE BAR  
STRUCTURES USING HYBRID MODEL OF  
ARTIFICIAL NEURAL NETWORK AND  
SIMULATED ANNEALING**

STUDENT 1, STUDENT 2

**GRADUATION PROJECT REPORT**  
Department of Mechanical Engineering

**Supervisor**  
Prof. Dr. Paşa YAYLA

ISTANBUL, 2014

**Kabul ve Onay Belgesi (İngilizce)**  
**Metindeki mor yazıları kendi tezinize uygun şekilde siyah olarak değiştiriniz.**  
**Bu metin kutusu ve gereksiz sayfaları siliniz.**



**MARMARA UNIVERSITY**  
**FACULTY OF ENGINEERING**



**Optimization of Space Bar Structures Using Hybrid Model of  
Artificial Neural Network and Simulated Annealing**

by

**Student 1, Student 2**

**May 24, 2014, Istanbul**

**SUBMITTED TO THE DEPARTMENT OF MECHANICAL ENGINEERING  
IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE**

**OF**

**BACHELOR OF SCIENCE**

**AT**

**MARMARA UNIVERSITY**

The author(s) hereby grant(s) to Marmara University permission to reproduce and to distribute publicly paper and electronic copies of this document in whole or in part and declare that the prepared document does not in anyway include copying of previous work on the subject or the use of ideas, concepts, words, or structures regarding the subject without appropriate acknowledgement of the source material.

Signature of Author(s) .....

Department of Mechanical Engineering

Certified By .....

Project Supervisor, Department of Mechanical Engineering

Accepted By .....

Head of the Department of Mechanical Engineering

## **ACKNOWLEDGEMENT**

First of all, I would like to thank my supervisor Prof.Dr. ..., for the valuable guidance and advice on preparing this thesis and giving me moral and material support.

**January, 2014**

Student Name

# CONTENTS

ACKNOWLEDGEMENT.....	ii
CONTENTS.....	iii
ÖZET.....	iii
ABSTRACT.....	iv
SYMBOLS.....	v
ABBREVIATIONS.....	vi
LIST OF FIGURES.....	viii
LIST OF TABLES.....	xi
1. INTRODUCTION.....	1
1.1. General Information.....	1
1.1.1. General Information.....	1
REFERENCES.....	3
APPENDICES.....	5

**İçindekiler kısmı yukarıdaki formatta MSWord'de Title komutu kullanılarak hazırlanabilir.**

## **ABSTRACT**

### **Optimization of Space Bar Structures Using Hybrid Model of Artificial Neural Network and Simulated Annealing**

Truss optimization has been an attractive area for researchers in recent years. Researchers are interested in this issue to find out how they can reduce the weight and cost while the structure satisfied with the physical constraints. To accomplish these requirements, trial and error method cannot be used because lots of trials will be required. Therefore, optimization methods should be used to find an optimum structure.

## **SYMBOLS**

**Ca** : coefficient of derivative control

## Tez Şablonu

Kısaltmalar alfabetik sırayla yazılmalıdır. Bu metin kutusunu siliniz...

### ABBREVIATIONS

<b>ADC</b>	: Analog Digital Converter
<b>ANN</b>	: Artificial Neural Network
<b>DAC</b>	: Digital Analog Converter
<b>HVAC</b>	: Heating, Ventilating and Air Conditioning
<b>NG</b>	: Negatif
<b>PID</b>	: Proportional Integral Derivative

## LIST OF FIGURES

	<b>PAGE</b>
<b>Figure 2.1.</b> Roulette-wheel selection scheme.....	1
<b>Figure 2.2.</b> Flow chart of hybrid method of ANN and optimization algorithms .....	25
<b>Figure 2.3.</b> Geometry of a twenty-five-bar truss structure.....	27
<b>Figure 2.4.</b> Geometry of a seventy-two bar truss structure.....	29



## **LIST OF TABLES**

	<b>PAGE</b>
<b>Table 2.1.</b> Roulette-wheel selection scheme.....	<b>12</b>
<b>Table 2.2.</b> Flow chart of hybrid method of ANN and optimization algorithms .....	<b>25</b>
<b>Table 2.3.</b> Geometry of a twenty-five-bar truss structure .....	<b>27</b>

## Tez Şablonu

Bölümlerin genel düzeni aşağıdaki gibi olmalıdır.  
Bu metin kutusu ye gereksiz metinleri siliniz.

# 1. INTRODUCTION

XX  
XX.

## 1.1. General Information

XX  
XX.

### 1.1.1. General Information

XX  
Denklem örneğidir:

$$\frac{x}{y} + \int_0^t e^{Rt} \leq \frac{dy}{dx} \quad (1.1)$$



Figure 1.1. Mühendislik Fakültesi logosudur. (ŞEKİL ÖRNEĞİ)

Table 1.1. Tablo düzeni örneğidir.

Parameter	Experiment 1	Experiment 2	Experiment 3
Mass (kg)	7,2	8,1	6,8
Temperature (°C)	22	21	23

Energy (J)

1,23

1,66

2,56

## REFERENCES

### Çeşitli örnekler aşağıda verilmiştir

#### Makale:

Yazar soyadı, yazar adının baş harfi., (yayın yılı). Makale Adı. Derginin Adı, cilt numarası (varsa parantez içinde sayısı), sayfa numaraları.

#### *Orn.*

Ercan, S. (1974) Cost Minimizing Single Sampling Plans with AIQL and AOQL Constaints. Management Science, Theory Series, 20, 1112-1122.

Hellinga, C., Schellen, A.A.J.C., Mulder, J.W., van Loosdrecht, M.C.M., Heijnen, J.J. (1998) The SHARON process: An innovative method for nitrogen removal from ammonium-rich waste water. Water Science and Technology, 37(9), 135-142.

Liu, J.X., Liang, Z. (2008) Landfill leachate treatment with a novel process: Anaerobic ammonium oxidation (Anammox) combined with soil infiltration system. Journal of Hazardous Materials, 151(1), 202-212.

#### Bildiri:

Yazar soyadı, yazar adının baş harfi., (yayın yılı). Bildiri Adı. Bilimsel Toplantının Adı, bilimsel toplantının düzenlendiği tarih ve şehir.

#### *Orn.*

Acar, M.H., Yılmaz, P. (1997) Effect of Tetramethylthiuramdisulfide on the Cationic Polymerization of Cylohexeneoxide. The 2<sup>nd</sup> International Conference on Advanced Polymers via Macromolecular Engineering, 2-14 August, Orlando, Florida, USA.

#### Kitap:

Yazar soyadı, yazar adının baş harfi., (yayın yılı). Kitabın Adı, cilt numarası (var ise) ve kaçınıcı baskı olduğu, Yayınevi, Yayımlandığı şehir.

#### *Orn.*

Bowersock, T.L., Park, K., Kosswig, K. (1997) Vaccines and Other Immunological Products, Encyclopedia of Pharmaceutical Technology, 1<sup>st</sup> Edition., Swarbrick, J., Boylan, J.C. Editors.; Marcel Dekker, Inc., New York, USA.

Çetmeli, E., Çakıroğlu, A., Uludağ, E. (1976) Yapı Statiği II, İ.T.Ü İnşaat Fakültesi Matbaası, İstanbul, Türkiye.

### **Tezler:**

Gümüő, F.U. (1998) Endosulfan'ın Kalıntı Analizlerine Uygun Yeni Yöntemlerin Geliőtirilmesi. Doktora Tezi, Marmara Üniversitesi Fen Bilimleri Enstitüsü, İstanbul, Türkiye, 77-79.

Nelson, M.R. (1988) Constraints on the Seismic Velocity Structure of the Crust and Upper Mantle Beneath the Eastern Tien Shan, Central Asia. PhD Thesis, MIT, Cambridge, MA, USA, 54-60.

### **Patent ve Standardlar**

Sisaky, A., Golab, F., Myer, B. (1989) Rust resistant Potatoes. UK Patent 2 394 783, Jan 23.

TS-40561 (1985) Çelik Yapıların Plastik Teoriye Göre Hesap Kuralları. Türk Standartlar Enstitüsü, Ankara, Türkiye.

### **Raporlar**

McCafirey, R., Abers, G. (1988) SYN3 : A program for Inversion of Teleseismic Body Wave Forms on Microcomputers. Air Force Geophysics Laboratory Technical Report, AFGL-TR-88-0099, Hanscomb Air Force Base, MA.

### **Elektronik Yayınlar**

Svoboda, K. P. (2004) Herbs, Spices, and Condiments. [Encyclopedia of Plant and Crop Science](#) (2004) 559-563, <http://www.dekker.com/sdek/abstract> (17.09.2007).

T.C. Ölçme, Seçme ve Yerleştirme Merkezi, Aday İşlemleri Sistemi, <http://ais.osym.gov.tr/>, 07 Mart 2012.

### **Kişisel Görüşmeler**

Özçelik, N. (2001) Kişisel Görüşme. Çanakkale Seramik Fbr. A.Ş

# APPENDICES