# ADAPTIVE NEAR-FIELD FOCUSING FOR WIRELESS POWER TRANSFER APPLICATIONS

By

Boules Atef Mouris Nessim

A Thesis Submitted to the
Faculty of Engineering at Cairo University
in Partial Fulfilment of the
Requirements for the Degree of
MASTER OF SCIENCE
in
ELECTRONICS AND COMMUNICATIONS ENGINEERING

FACULTY OF ENGINEERING, CAIRO UNIVERSITY
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**Title of Thesis:**

ADAPTIVE NEAR-FIELD FOCUSING FOR WIRELESS POWER TRANSFER APPLICATIONS

**Key Words:**
Wireless Power Transmission, Adaptive Antenna, Near-Field Power Focusing, Source Localization, Beamforming

**Summary:**
A wireless power transfer system based on the concept of Near-Field Focusing is proposed in this thesis. The proposed system uses MUltiple SIgnal Classification algorithm for localizing the targets. A Minimum Mean Square Error beamforming technique is subsequently used in order to focus the RF power at the targets locations. Different parameters impacting the power transmission efficiency are studied. Results show a relatively high power density at the desired locations

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# Dedication

To my family and my friends

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# List of Symbols and Abbreviations

| Abbreviations | Description |
|---|---|
| **BTS** | Base Station. |
| **DC** | Direct Current. |
| **DOA** | Direction Of Arrival. |
| **EIRP** | Effective Isotropic Radiated Power. |
| **EM** | ElectroMagnetic. |
| **ESPIRIT** | Estimation of Signal Parameters via Rotational Invariance Technique. |
| **MMSE** | Minimum Mean Square Error. |
| **MUSIC** | MUltiple SIgnal Classification. |
| **MVDR** | Minimum Variance Distortionless Response. |
| **NFF** | Near-Field Focused. |
| **PEC** | Perfect Electric Conductor. |
| **Rectenna** | Rectifying-Antenna. |
| **RF** | Radio Frequency. |
| **RFID** | Radio Frequency IDentification. |
| **ULA** | Uniform Linear Array. |
| **WPT** | Wireless power transfer. |

| Symbols | Description |
|---|---|
| $\lambda$ | Wavelength. |