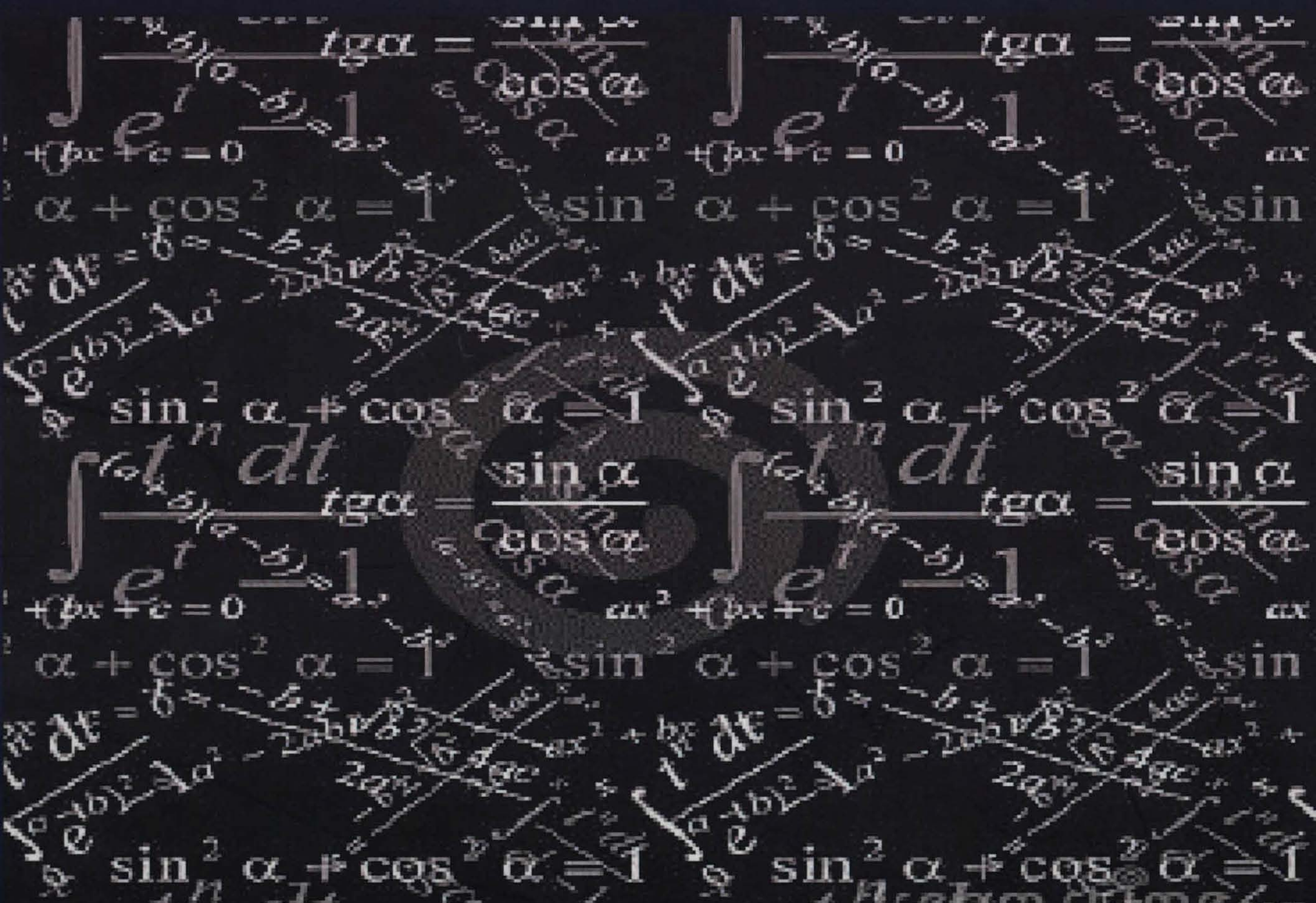
الجامعة الإسلامية العالمية ماليزيا
INTERNATIONAL ISLAMIC UNIVERSITY MALAYSIA
يونيۏرسيتي إسلام انتارابڠسا مليسيا

VOLUME 2

RECENT ACHIEVEMENTS IN DYNAMICAL SYSTEMS

Proceedings of Department of Computational and Theoretical Sciences, Faculty of Science, IIUM



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Vol. 2

IIUM Press

Published by:
IIUM Press
International Islamic University Malaysia

First Edition, 2011

Perpustakaan Negara Malaysia Cataloguing-in-Publication Data

Farrukh Mukhamedov, Nasir Ganikhodjaev & Mansoor Saburov
Recent Achievements in Dynamical Systems
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ISBN: 978-967-418-201-4

Member of Majlis Penerbitan Ilmiah Malaysia – MAPIM
(Malaysian Scholarly Publishing Council)

Printed by :
IIUM PRINTING SDN. BHD.
No. 1, Jalan Industri Batu Caves 1/3
Taman Perindustrian Batu Caves
Batu Caves Centre Point
68100 Batu Caves
Selangor Darul Ehsan

Contents

Part I. Quadratic Operators and Their Dynamics

Part II. Dynamical Systems Arising From Physical Models

MODULATIONAL INSTABILITY IN SALERNO MODEL

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Abstract

We investigate the properties of modulational instability in the Salerno equation in quasi-one dimension in Bose-Einstein condensate (BEC). We analyze the regions of modulational instability of nonlinear plane waves and determine the conditions of its existence in BEC.

Keywords: *Modulational instability, Salerno model, Bose-Einstein condensate.*

Introduction

The modulational instability is known phenomenon to be fundamental subject of the theory of nonlinear waves. This phenomenon consists of the instability of nonlinear plane waves against weak long-scale modulations with wave numbers (frequency) lower than some critical value. It has been predicted by Banjamen and Feir [3] for waves in deep water and by Bespalov and Talanov [2] for electro-magnetic waves in nonlinear media with cubic nonlinearity. Later, it was observed in nonlinear optics [7, 9, 11], plasma physics [5, 6], and condensate matter (Bose-Einstein Condensate, long Josephson junction,...) [8, 10]. In this work, we determine the regions and conditions of existence of modulational instability in Bose-Einstein condensate in periodic potential trap (optical lattices).

The Model

It is very important to investigate the modulational instability in different models. We restrict ourselves to the Salerno model in Bose-Einstein condensate in optical lattice in quasi-1D. This model is a combination of the discrete non-linear Schrodinger (DNLS) equation [4] with cubic nonlinearity and Ablowitz-Ladik (AL) equation[1]. It is given by [5]

$$i\,\dot{\phi} + (1 + \mu|\phi_n|^2)\,(\phi_{n+1} + \phi_{n-1}) + 2v|\phi_n|^2\phi_n = 0, \qquad (1)$$

where ϕ_n is the complex field amplitude at n^{th} site of the lattice, μ is the nonlinearity of (AL) equation, v is the nonlinearity of (DNLS) equation.