CONTENTS:

A. Nowicki
Hermitean Oscillator-like Realizations of Classical Algebras and Superalgebras in Hilbert Space with Positive Definite Metric 649—673

A. Cabo
On the Bosonization of the Many Electron Problem 675—685
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1. Only papers not published and not submitted for publication elsewhere will be accepted.
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Hermitean Oscillator-like Realizations of Classical Algebras and Superalgebras in Hilbert Space with Positive Definite Metric

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Abstract

The hermitean oscillator-like realizations of classical algebras in terms of bosonic and fermionic creation and annihilation operators are given. The hermitean realizations of classical superalgebras using boson-fermion oscillators are explicitly described. The assumption of positive definite metric in a Hilbert space of the oscillators states is exploited. Due to this fact, the realizations of superalgebras in the Hilbert space can be constructed only for: the real orthosymplectic superalgebra \( \text{osp}(N; 2M; R) \); the unitary compact superalgebra \( \text{su}(N; M) \); the unitary noncompact one \( \text{SU}(N; K, M) \); and the quaternionic unitary superalgebra \( \text{uu}_4(N; M; H) \).

1. Introduction

In the last decade, we observe increasing interest in application of the supersymmetry methods as the investigation tools in the theory of fundamental interactions as well as in nuclear physics.

The classification of supersymmetry algebras has been given by Kac [1, 2] which contains all complex finite-dimensional simple Lie superalgebras. Following [1, 2] the classical Lie superalgebras (i.e. simple Lie superalgebras whose Lie subalgebra is reductive) can be divided into four classes:

a) standard classical Lie superalgebras \( A(n, m), B(n, m), C(n) \) and \( D(n, m) \);
b) exceptional Lie superalgebras \( F(4), G(3) \);
c) strange Lie superalgebras \( P(n), Q(n) \);
d) one-parameter family of deformations of \( D(2, 1) \) denoted by \( D(2, 1; \alpha) \).

The standard classical Lie superalgebras are supersymmetric analogues of Cartan classical Lie algebras. The classification of real forms of classical Lie superalgebras are given in [3].

Recently, the realizations of supersymmetry algebras using the oscillator operators was proposed. It is connected with the problem of bosonization of the fermionic systems [4, 5] as well as the description of unitary irreducible representations of noncompact supersymmetries [6—8].

By the oscillator method, using bosonic and fermionic oscillators there were constructed unitary irreducible representations of:

i) anti-de Sitter superalgebra \( \text{osp}(2; 4; R) \) in [9];
ii) extended anti-de Sitter superalgebra \( \text{osp}(N; 4; R) \) in [10];

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