## ABSTRACT

### INVESTIGATION OF QUANTUM ENTANGLEMENT IN J1-J2 HEISENBERG XXZ SPIN SYSTEMS

Alev ŞAHİNTAŞ

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Supervisor: Asst. Prof. Dr. Cenk AKYÜZ
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Since the beginning of the quantum mechanics, low-dimensional systems have always emerged as an important research field. Therefore, in this thesis, we examined the entanglement properties of the one of the low-dimensional system called anisotropic four qubit Heisenberg XXZ system with DM interaction. This system has both the nearest neighboring and the next nearest neighboring interaction. First, calculations of the ground state entanglement are carried out. From the essential evidences obtained, we see that DM interaction and the frustration play an active role on the ground state entanglement between the nearest neighboring and the next nearest neighboring qubits, respectively. Second, thermal entanglement calculations of the system are fulfilled with the conjuction of the temperature and other control parameters such as DM interaction,anisotropy and frustration. As a result of calculations,we see that both temperature and frustration parameters exhibit positive effects on the thermal entanglement especially between the next nearest neighboring qubits. Finally, we construct a more general Heisenberg model by considering not only the nearest neighboring interaction but also the next nearest neighboring interaction and DM interaction. So, we show that effective control of entanglement can be obtained by employing competing effects of the control parameters in this model.



**Key Words**
Anisotropy parameter, DM interaction, entanglement, $J_1 - J_2$ Heisenberg XXZ model, qubit.