学位論文題目　　Application of Underdetermined Linear Systems to DOA Estimation and Near Field Source Reconstruction.

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Wireless communication technology is an indispensable technology in this era. It continues to play an important role in our daily activities. The basic role played by mathematics is indisputable in modeling and optimization of wireless systems. In this study, we develop mathematical models that achieves improved system performance. These models are specially applied to underdetermined direction of arrival (DOA) estimation and near field to far field reconstruction. The two problems addressed in this dissertation utilizes underdetermined linear systems.

In Chapter 3, to improve DOA algorithm's performance as well as achieve improved DOA estimation characteristics, a nested sparse circular array (NSCA) is proposed. Virtual sensors in concentric extension of the proposed array are utilized which achieves increased degrees of freedom. By using the method developed in this chapter, we are capable of estimating mores sources with fewer sensors. In DOA estimation problems, mutual coupling affect the system performance. In Chapter 4, we consider the problem of mutual coupling compensation in which a mutual coupling compensation method is proposed for NSCA. The method attains improved DOA estimation performance and accuracy, and lower average run-time. The work in Chapters 3 and 4 is extended in Chapter 5 whereby wideband signal sources are considered.

Chapter 6 discusses a mathematical model applied to antenna measurement problem. For a very large antenna system, general far field measurements are impossible. In this case, near field measurement provides a leeway in which the far field can be calculated from the measured near field data. A hemispherical near field measurement technique is discussed from which far field is estimated including the effect of real ground. This work is extended in Chapter 7 in which complex models are used. In our analysis, a real Prius car model is examined.

In this study, robust mathematical models have been proposed which improves the performance of wireless communication systems. The performance of DOA estimation algorithms and effect of mutual coupling have been considered in both narrowband and wideband sources. In antenna measurement application, mathematical models were proposed in which far field is estimated from hemispherically measured near field and the effect of real ground on the far field is included.