
**Low Profile Natural and Metamaterial Antennas with Emphasis
on Dual-, Wide-, and Extremely Wide-band Operation**
Hisamatsu Nakano, Hosei University, Japan

Abstract: Antennas with dual-, multi-, wide-, and extremely wide-band operation have been receiving considerable attention, in response to recent developments in communication systems, e.g., mobile, digital TV, and satellite communication systems. These antennas are categorized as either natural or metamaterial (MTM) antennas. The former have an electromagnetic property found in nature (right-handed property) and the latter have an electromagnetic property not existing in nature (left-handed property or composite right- and left-handed property).

This talk presents recent progress in natural and MTM antennas, with an emphasis on realization of dual-, multi-, wide-, and extremely wide-band operation, and is composed of three chapters. Chapter 1 describes a natural cross element that acts as an extremely wide-band antenna. The antenna design process is explained and a technique to generate a stopband within the VSWR frequency response is introduced. Chapter 2 presents MTM loop antennas. The analysis reveals that a closed MTM loop acts as a linearly polarized (LP) multi-band antenna. In addition, the analysis finds the fact that an open MTM loop realizes dual-band counter circularly polarized (CP) radiation. Chapter 3 focuses on natural and MTM spiral antennas. The effects of the natural spiral antenna height on the radiation characteristics are analyzed. Operation of counter CP radiation from the MTM spiral is investigated and the gain enhancement is discussed.



Prof. Hisa-matsu Nakano has been a faculty member of Hosei University since 1973. He has published over 300 articles in major refereed journals and is the author or co-author of 10 books. He has been an IEEE Life Fellow since 2011. His significant contributions are the development of 5 integral equations for line antennas and the realization of numerous wideband antennas, such as curl, spiral, helical, and cross-wire antennas. His other accomplishments include antennas for GPS, personal handy phone systems, space radio, electronic toll collection systems, RFID systems, UWB systems, and radar systems. Prof. Nakano received the IEEE APS H. A. Wheeler Award in 1994, the IEEE APS Chen-To Tai Distinguished Educator Award in 2006, and the Prize for Science and Technology from Japan's Minister of Education, Culture, Sports, Science, and Technology in 2010. He has served as a member of IEEE APS AdCom (2000-2002), an IEEE APS Region 10 representative (2004-2010), the chair of IEEE AP-S best papers award committee (2011-2013), an IEEE APS short course lecturer (2007-present), etc.