1. Record Nr. UNINA9910821667603321 Autore Li Changzhi <1982-> Titolo Microwave noncontact motion sensing and analysis / / Changzhi Li, Jenshan Lin Pubbl/distr/stampa Hoboken, New Jersey:,: John Wiley & Sons Inc.,, [2014] ©2014 **ISBN** 1-118-74256-7 1-118-74255-9 1-118-74279-6 Descrizione fisica 1 online resource (220 p.) Collana Wiley series in microwave and optical engineering TEC036000 Classificazione Altri autori (Persone) LinJenshan <1984-> 681/.2 Disciplina Soggetti Motion detectors Microwave detectors Motion - Measurement Radar Lingua di pubblicazione Inglese **Formato** Materiale a stampa Livello bibliografico Monografia Note generali Bibliographic Level Mode of Issuance: Monograph Nota di bibliografia Includes bibliographical references and index. Nota di contenuto Preface xi 1 Introduction 1 1.1 Background, 1 1.2 Recent Progress on Microwave Noncontact Motion Sensors, 2 1.2.1 Microwave/Millimeter-Wave Interferometer and Vibrometer, 2 1.2.2 Noncontact Vital Sign Detection, 3 1.3 About This Book, 4 2 Theory of Microwave Noncontact Motion Sensors 7 2.1 Introduction to Radar, 7 2.1.1 Antennas, 8 2.1.2 Propagation and Antenna Gain, 10 2.1.3 Radio System Link and Friis Equation, 13 2.1.4 Radar Cross Section and Radar Equation, 15 2.1.5 Radar Signal-To-Noise Ratio, 16 2.1.6 Signal-Processing Basics, 17 2.2 Mechanism of Motion Sensing Radar, 18 2.2.1 Doppler Frequency Shift, 18 2.2.2 Doppler Nonlinear Phase Modulation, 19 2.2.3 Pulse Radar, 26 2.2.4 FMCW Radar, 27 2.2.5 Comparison of Different Detection Mechanisms, 29 2.3 Key Theory and Techniques of Motion Sensing Radar, 31 2.3.1 Null and Optimal Detection Point, 31 2.3.2 Complex Signal Demodulation, 33 2.3.3 Arctangent Demodulation, 34 2.3.4 Double-Sideband Transmission, 36 2.3.5 Optimal Carrier Frequency.

43 2.3.6 Sensitivity: Gain and Noise Budget, 49 3 Hardware

Development of Microwave Motion Sensors 53 3.1 Radar Transceiver,

53 3.1.1 Bench-Top Radar Systems, 53 3.1.2 Board Level Radar System Integration, 61 3.1.3 Motion Sensing Radar-On-Chip Integration, 63 3.1.4 Pulse-Doppler Radar and Ultra-Wideband Technologies, 85 3.1.5 FMCW Radar, 89 3.2 Radar Transponders, 92 3.2.1 Passive Harmonic Tag, 93 3.2.2 Active Transponder for Displacement Monitoring, 95 3.3 Antenna Systems, 99 3.3.1 Phased Array Systems, 99 3.3.2 Broadband Antenna, 100 3.3.3 Helical Antenna, 103 4 Advances in Detection and Analysis Techniques 107 4.1 System Design and Optimization, 107 4.1.1 Shaking Noise Cancellation Using Sensor Node Technique, 107 4.1.2 DC-Coupled Displacement Radar, 111 4.1.3 Random Body Movement Cancellation Technique, 116 4.1.4 Nonlinear Detection of Complex Vibration Patterns, 124 4.1.5 Motion Sensing Based on Self-Injection-Locked Oscillators, 131 4.2 Numerical Methods: Ray-Tracing Model, 136 4.3 Signal Processing, 141 4.3.1 MIMO, MISO, SIMO Techniques, 141 4.3.2 Spectral Estimation Algorithms, 142 4.3.3 Joint Time-Frequency Signal Analysis, 153 5 Applications and Future Trends 157 5.1 Application Case Studies, 158 5.1.1 Assisted Living and Smart Homes, 158 5.1.2 Sleep Apnea Diagnosis, 164 5.1.3 Wireless Infant Monitor, 169 5.1.4 Measurement of Rotational Movement, 173 5.1.5 Battlefield Triage and Enemy Detection, 178 5.1.6 Earthquake and Fire Emergency Search and Rescue, 179 5.1.7 Tumor Tracking in Radiation Therapy, 180 5.1.8 Structural Health Monitoring, 185 5.2 Development of Standards and State of Acceptance, 194 5.3 Future Development Trends, 196 5.4 Microwave Industry Outlook, 202 References 203 Index 215

Sommario/riassunto

"Compiling the authors? combined decades of experience, Microwave Noncontact Motion Sensing and Analysis sheds light on microwave noncontact vital sign detection from bench-top module to CMOS integrated microchip, covering a frequency range of over 30 GHz. Providing timely coverage of a technology integral to the future healthcare of the elderly, the text presents a full-bodied history of this technology, introduces current developments, and reveals future trends. Practicing engineers and researchers will discover the theory and technical details of related technologies, as well as a wide range of applications in healthcare, military, and industry"--