



System Work of Intelligent Metasurfaces for Electromagnetic Detection and Sensing

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The electromagnetic (EM) intelligent metasurfaces [1] based on reconfigurable, programmable and adaptable technologies for manipulating spatial EM features have always been the focus and hot spots in recent years. More and more works in the area of metasurface are concentrating in the active design rather than the passive one in the microwave band typically. The programmable aperture [2] of transmitting or receiving with utilizing appropriate algorithms for detection, and multiplexing EM aperture for sensing and automatic feedback control without human intervention [3], are two main categories of the methods to realize intelligent metasurface.

For actualizing the designs mentioned above, the system work which includes the developing of period reconfigurable EM textures, baseband controlling circuit (FPGA device in general) and corresponding algorithms for active detection and passive sensing, especially with introducing the method of artificial intelligent (AI). Our group are focusing on this research area for several years, and many new methods for designing and applying intelligent metasurface are proposed to achieve the transmitting or receiving controls of spatial EM waves and filed, to complete the EM detection and sensing based on the data collection by metasurface apertures. Accordingly, the detection work of EM imaging or the characteristics recognition of target and the sensing work of direction of arrival (DoA) estimation are achieved in the near field and far field separately with the considering of the low power applications. Also, all of the electrically controlling parts of intelligent metasurface and measurement instruments are operated under the synchronous instructions by Labview software. In addition, the frequency modulation continuous wave (FMCW) based transceiver which speed of signal acquirement is much higher than the measurement instrument is preferred to use for solving the detection problems of dynamic targets. Many details of former and new designs for intelligent metasurface will be introduced and discussed in the conference.

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