Highly Efficient Hybrid Plasmonic Leaky-Wave Optical Antenna with Controlling Slot's Shapes

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In designing optical antennas, efficiency, directivity and impedance matching are serious concerns and many effort are investigated to improve these specifications of optical antennas. Among different types of optical antennas, hybrid plasmonic leaky-wave antennas are highly directive antennas that have the advantage of feasibility to fabricate and integrate with other parts of photonic integrated circuits (PIC) much easier than other types of optical antennas. The fundamental principle of this type of antenna is transforming a guided mode to a propagating mode, which transformation of modes is done through the vertical slots along the antenna structure. In that way, the efficiency of this type of antenna improves by minimizing the transmitted wave to receiver port of the plasmonic waveguide. In this work, a novel design of hybrid plasmonic leaky-wave antennas is proposed, which the received wave at the end of the waveguide is much less than previous works without disturbing antenna's matching. Here, contrast to other works, slots along the antenna have different shapes. By optimizing slot's shape and dimensions, transformation between guided mode and propagating mode increases. This slot optimization, should not increase side-lobe level (SLL) or reduce directivity, which is the challenging part of the design. In this work, for two different shapes of slots, optical antenna is designed to cover the standard optical communication bands of E, S, and C with efficiency better than 85 % and around 15 dBi directivity. Beside, increasing propagation mode, bandwidth of the proposed antenna increases in the proposed design compare with other works.