Analytical Approaches to Coupled Surface-Radiation Modes in Finite and Tapered Structures

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Since its advent some forty years ago during its application to early frequency measurement techniques, interest in metal-barrier-metal structures of various geometries and arrangements has grown. While a basic understanding of the coupling to free-space radiation modes and of the mutual coupling between structures has evolved, there is need for simple analytical approaches. This is also driven by recent renewed interest in diverse applications driven n turn by the development of improved fabrication and control, better sources, and the interest in sub-micron quantum-optical-devices and systems.

It is well-known that there is a unity between the low frequency radiation characteristics and the optical frequency characteristics on finite structures, which is based upon antenna principles generalized to include surface waves. In this research the basic model and early results are extended. Recent developments include improved coupled-mode approaches to analytically model the mode-amplitude on the antenna induced by an incident free-space field. In this effort we are also developing a general coupled mode approach to describe tapered and other types of couplers as well as the coupling from the surface structure to devices, the simplest being a tunnel junction.