Abstracts

Traveling-Wave Amplifiers with Prescribed Frequency Response

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This paper develops the design of microwave transistor amplifier combinations that have controlled frequency response over a specified bandwidth. Theoretical analysis of such an amplifier with an arbitrary number of sections is presented. The response of the amplifier is controlled by tapering the frequency selectivity or Q of each section of the amplifier. To verify the theory, a three-section amplifier with maximally-flat time delay response is designed, constructed, and evaluated. Existing traveling-wave amplifiers are modeled as lossy transmission lines. Although the amplifiers are relatively broadband, a prescribed frequency response is not achieved, and each transistor does not receive an equal portion of the signal power. Resistive elements are required for impedance matching at the input and output. The amplifier design developed in this work seeks to improve on existing techniques by trading bandwidth for controlled gain. By making the transmission line that connects the amplifier sections non-uniform, the frequency response is controlled over the design bandwidth. The impedance of the transmission lines is specified so that all of the input power is delivered to each transistor equally. No resistive elements are required for impedance matching, thus reducing the inherent noise of the amplifier. The designs are easily implemented using familiar components.

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