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Optimal Design of a Traveling-Wave Kinetic Inductance Amplifier Operated in Three-Wave Mixing Mode[1] ROBERT ERICKSON, MUSTAFA BAL, KSIANG-SHENG KU, XIAN WU, DAVID PAPPAS, NIST —

In the presence of a DC bias, an injected pump, of frequency f_P, and a signal, of frequency f_S, undergo parametric three-way mixing (3WM) within a traveling-wave kinetic inductance (KIT) amplifier, producing an idler product of frequency $f_I = f_P - f_S$. [M. R. Vissers, R. P. Erickson, H.-S. Ku, Leila Vale, Xian Wu, G. C. Hilton, and D. P. Pappas, Appl. Phys. Lett. 108, 012601 (2016).] Periodic frequency stops are engineered into the coplanar waveguide of the device to enhance signal amplification. With f_P placed just above the first frequency stop gap, 3WM broadband signal gain is achieved with maximum gain at $f_S = f_P/2$. Within a theory of the dispersion of traveling waves in the presence of these engineered loadings [R. P. Erickson and D. P. Pappas, to be submitted to Phys. Rev. B.], which accounts for this broadband signal gain, we show how an optimal frequency-stop design may be constructed to achieve maximum signal amplification. The optimization approach we describe can be applied to the design of other nonlinear traveling-wave parametric amplifiers.

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