Abstract Submitted
for the MAR11 Meeting of
The American Physical Society

Parametric Amplification in Discrete Josephson Transmission Line HAMID REZA MOHEBBI, A. MAJEDI MAJEDI, University of Waterloo, Institute for Quantum Computing — A Series-connected discrete Josephson transmission line (DJTL) which is periodically loaded by open stubs is studied to investigate various aspects of traveling-wave parametric amplification. The dispersion analysis is made to ensure the existence of three non-degenerate time-harmonic waves interacting with each other through the phase matching condition which is imposed by the cubic nonlinearity associated with each junction. Having weak nonlinearity and slow varying assumptions, we exploit the perturbation theory with the multiple scale technique to derive the three coupled nonlinear partial differential equations to describe their spatial and temporal amplitude variations in this parametric interaction. Cases of perfect phase-matching and slight mismatching are addressed in this work. The numerical analysis based on the spectral method in space and finite difference in time domain are used to monitor the unilateral gain, stability and bandwidth of the proposed structure. This structure can be used as a mesoscopic platform to study the creation of squeezed states of the microwave radiation. These properties make this structure desirable for applications ranging from superconducting optoelectronics to dispersive readout of superconducting qubits where high sensitivity, fast speed and low-noise operation is required.

Hamid Reza Mohebbi
University of Waterloo, Institute for Quantum Computing

Date submitted: 28 Nov 2010 Electronic form version 1.4