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Quantum dynamics for a dissipative quantum harmonic oscillator as a model for a NEMS frequency control resonator[1] ILKI KIM, GERALD J. IAFRATE, Dept. of Electrical and Computer Eng., NC State Univ., Raleigh, NC 27695 — For the simplest model of dissipation, that is, a linear oscillator coupled to an infinite number of degrees of freedom to form a dissipative bath, it is found that the Heisenberg equation of motion for the oscillator displacement takes the form of a Langevin equation with a memory dependent dissipation [Ford, Lewis, O'Connell; Phys. Rev. A 37, 004419 (1988)]. When Fourier analyzed, this leads to a complex susceptibility which gives rise to a generalized frequency dependent "quality factor" which relates to the dissipative environment. We explore the limits of resonator integrity, especially with regard to insights afforded by the dependence of quality factor and other observables on the microscopic connection between resonator material parameters and circuit performance.

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