Localized oscillator in a cavity: an adapted spectral approach

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Abstract:

We consider a very general model in a cavity where a wave equation is coupled to a localized oscillator. This can arise in many contexts like an array of Josephson junctions in superconductivity or an electromagnetic wave coupled to a ferroelectric film. The model consists in the wave equation coupled to a Duffing oscillator for the film which we assume infinitely thin. We derive the normal modes of the system and show that they are orthogonal with a special inner product which we introduce. These modes are well suited to describe the system even for a film of finite thickness. By acting on the film we demonstrate switching from one cavity mode to another. Since the system is linear, little energy is needed for this conversion. Moreover the amplitude equations describe very well this complex system under different perturbations (damping, forcing and nonlinearity) with very few modes. These results are very general and can be applied to different situations like for an atom in a cavity or a Josephson junction in a capacitor and this could be very useful for many nano-physics applications.

References:

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