This book focuses on nonlinear optical phenomena in periodic media, such as photonic crystals, optically-induced, adaptive lattices, atomic lattices or metamaterials. The main purpose is to describe and overview new physical phenomena that result from the interplay between nonlinearities and structural periodicities and is a guide to actual and future developments for the expert reader in optical information processing, as well as in the physics of cold atoms in optical lattices. Optical Metamaterials: Invisibility in Visible and Nonlinearities in Reverse. Pages 217-240. Litchinitser, Natalia M. (et al.) Preview Buy Chapter 24.95 â‚¬. Nonlinear Metamaterials. Pages 241-257. Shadrivov, Ilya V. Preview Buy Chapter 24.95 â‚¬. Circuit Model of Gain in Metamaterials. Pages 259-272. Nonlinear metamaterials are a periodic, nonlinear, transmission medium. These are a type of negative index metamaterial where the nonlinearity is available because the microscopic electric field of the inclusions can be larger than the macroscopic electric field of the electromagnetic (EM) source. This then becomes a useful tool which allows for enhancing the nonlinear behavior of the metamaterial. For nonlinear metamaterial, the translation effect of the external excitation amplitude on the bandgap range and the zero mass at the nonlinear bandgap cutoff frequency were discussed, and all above conclusion are identified by numerical analysis. A. Marathe and A. Chatterjee, "Wave attenuation in nonlinear periodic structures using harmonic balance and multiple scales," Journal of Sound and Vibration, vol. 289, no. 4-5, pp. 871â€“888, 2006. View at: Publisher Site | Google Scholar. R. K. Narisetti, M. J. Leamy, and M. Ruzzene, "A perturbation approach for predicting wave propagation in one-dimensional nonlinear periodic structures," Journal of Vibration and Acoustics of the ASME, vol. 132, no. 3, Article ID 031001, 2010. View at: Google Scholar.