A new concept of the quadratic-nonlinearity power-index spectrum, QNLPI(f), that can be used in signal detection and classification, is proposed based on the bicoherence spectrum. The proposed QNLPI(f) is derived as a projection of the 3-D bicoherence spectrum into 2-D spectrum that quantitatively describes how much of the mean square power at a certain frequency f is generated by nonlinear quadratic interaction between different frequencies. The proposed index, QNLPI(f), can be used to simplify the study of bispectrum and bicoherence signal spectra. It also inherits useful characteristics from the bicoherence such as high immunity to additive gaussian noise, high capability of nonlinear-system identifications, and amplification invariance. Concept of the proposed index and its computational considerations are discussed first using computer-generated data and then applied to real-world vibration data from a helicopter drive train to assess health conditions of different mechanical faults as a part of condition-based maintenance.