

Nonlinearity always brings difficulties to the analysis and design of practical systems. This study shows that, for a wide class of nonlinear systems described by nonlinear differential equations, the nonlinear output spectrum can be expressed as a polynomial function with respect to linear model parameters, based on the recently developed concepts of parametric characteristic analysis and nonlinear Characteristic Output Spectrum (nCOS) function. The coefficients of the new nCOS function are independent of the linear parameters of interest, and can be directly determined with proposed procedures. This reveals an explicit and analytical relationship between the output spectrum of a nonlinear system and its linear components, and therefore provides a convenient tool for the analysis and design of nonlinear systems using only linear components or linear feedback control while simultaneously fully considering inherent nonlinear influence. This result is a useful complement to the nCOS function-based analysis and design recently developed in the literature. The effectiveness and usefulness of the results are demonstrated through an application to the analysis of an amplifier with a multi-tone input for suppressing intermodulation distortion. It is shown that the new results reveal a straightforward insight into the parametric optimization of the amplifier for suppression of intermodulation distortion.