



# Symbolic Analysis in Analog Integrated Circuit Design (The Springer International Series in Engineering and Computer Science)

*Henrik Floberg*

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*Symbolic Analysis in Analog Integrated Circuit Design* provides an introduction to computer-aided circuit analysis and presents systematic methods for solving linear (i.e. small-signal) and nonlinear circuit problems, which are illustrated by concrete examples. Computer-aided symbolic circuit analysis is useful in analog integrated circuit design. Analytic expressions for the network transfer functions contain information that is not provided by a numerical simulation result. However, these expressions are generally extremely long and difficult to interpret; therefore, it is necessary to be able to approximate them guided by the magnitude of the individual circuit parameters.

Engineering has been described as 'the art of making approximations'. The inclusion of symbolic analysis in analog circuit design reduces the implied risk of ambiguity during the approximation process. A systematic method based on the nullor concept is used to obtain the basic feedback transistor amplifier configurations. Approximate expressions for the locations of poles and zeros for linear networks are obtained using the extended pole-splitting technique. An unusual feature in *Symbolic Analysis in Analog Integrated Circuit Design* is the consistent use of the transadmittance element with finite (linear or nonlinear) or infinite (i.e. nullor) gain as the only requisite circuit element. The describing function method is used to obtain approximate symbolic expressions for the harmonic distortion generated by a soft or hard transconductance nonlinearity embedded in an arbitrary linear network. The design and implementation of a program (i.e. CASCA) for symbolic analysis of time-continuous networks is described. The algorithms can also be used to solve other linear problems, e.g. the analysis of time-discrete switched-capacitor networks.

*Symbolic Analysis in Analog Integrated Circuit Design* serves as an excellent resource for students and researchers as well as for industry designers who want to familiarize themselves with circuit analysis. This book may also be used for advanced courses on the subject.

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