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# COMMUNICATION SYSTEMS

*An Introduction to Signals and Noise  
in Electrical Communication*

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FOURTH EDITION

A. Bruce Carlson

*Rensselaer Polytechnic Institute*

Paul B. Crilly

*University of Tennessee*

Janet C. Rutledge

*University of Maryland at Baltimore*



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*To the memory of my father and mother,  
Albin John Carlson and Mildred Elizabeth Carlson*  
A. Bruce Carlson

*To my parents,  
Lois Crilly and I. Benjamin Crilly*  
Paul B. Crilly

*To my son, Carter:  
May your world be filled with the excitement of discovery*  
Janet C. Rutledge

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The numbers in parentheses after section titles identify previous sections that contain the minimum prerequisite material. The symbol ★ identifies optional material.

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