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Work by Prof. Wornell and his collaborators is summarized here

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Interim Progress Report for
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Advanced Signal Processing Techniques for Wireless Communications

for the period

November 1, 1995 through May 31, 1996

Principal Investigator: Prof. Gregory W. Wornell

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Our research continues to have several components. This period we have continued to develop and improve our promising new class of bandwidth-efficient temporal diversity strategies for single- and multi-user wireless communication in time-selective multipath fading environments. Recent work has focussed on efficient interference suppression algorithms for use with these systems.

We have also developed a closely related class of computation- and bandwidth-efficient techniques for exploiting spatial diversity at the transmitter in wireless systems, which are useful either alone or in conjunction with other forms of diversity. As part of this component of the work, we have also continued to explore the broader role of multirate signal processing theory in wireless and wireline communication applications.

Another component of the research in progress is exploring the use of nonlinear dynamics and chaos in the design of error-correcting codes for communications applications. Simulaneously, we have begun our exploration of the use of fractal traffic models in the design and management of efficient, next-generation packet-switched communication networks. Finally, we have been investigating optimum protocols for packet-switched communications over channels with feedback.

The results for this period are described in detail in the following publications, which consist of journal articles, conference papers, technical reports, and student theses.

1. G. W. Wornell, "Spread-Response Precoding for Communication over Fading Channels," *IEEE Trans. Inform. Theory,* vol. 42, no. 2, pp. 488–501, Mar. 1996.

2. W. M. Lam and G. W. Wornell, "Multiscale Representation and Estimation of Fractal Point Processes," *IEEE Trans. Signal Processing,* vol. 43, no. 11, pp. 2606–2617, Nov. 1995.

3. G. W. Wornell, "Emerging Applications of Multirate Signal Processing and Wavelets in Digital Communications," in *Proc. IEEE,* Special Issue on Applications of Wavelets (invited paper), vol. 84, no. 4, pp. 586–603, Apr. 1996.

4. G. W. Wornell and M. D. Trott, "Efficient Signal Processing Techniques for Exploiting Transmit Antenna Diversity on Fading Channels," submitted to *IEEE Trans. Signal Processing,* Special Issue on Signal Processing Advances in Communications, Dec. 1995.

5. G. W. Wornell and M. D. Trott, "Signal Processing Techniques for Efficient Use of Transmit Diversity in Wireless Communications," in *Proc. Int. Conf. Acoust., Speech, Signal Processing,* (Atlanta), May 1996. (invited paper)

6. W. M. Lam and G. W. Wornell, "Multiscale Analysis of Fractal Point Processes and Queues," in *Proc. Int. Conf. Acoust., Speech, Signal Processing,* (Atlanta), May 1996.

7. B. Chen and G. W. Wornell, "Efficient Channel Coding for Analog Sources using Chaotic Systems" submitted Feb. 1996 to *IEEE GLOBECOM,* (London).

8. J. M. Ooi and G. W. Wornell, "Decentralized Control of a Multiple Access Broadcast Channel: Performance Bounds," submitted Feb. 1996 to *Int. Conf. Dec. Control,* (Japan).

9. Chen, Brian, "Efficient Communication over Additive White Gaussian Noise and Intersymbol Interference Channels Using Chaotic Sequences," RLE Technical Report No. 598, Research Laboratory of Electronics, MIT, Cambridge, MA, April 1996.

10. Chen, Brian, "Efficient Communication over Additive White Gaussian Noise and Intersymbol Interference Channels Using Chaotic Sequences," S.M. Thesis, MIT, Cambridge, MA, Feb. 1996.

11. Beheshti, Soosan, "Techniques for Enhancing the Performance of Communication Systems Employing Spread-Response Precoding," S.M. Thesis, MIT, Cambridge, MA, Feb. 1996.

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