

# Literature Review: Coherence with Gaps

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## 1 Basic Papers

### 1.1 Spectrum Estimation and Harmonic Analysis

The relevant material here is in [t82, §XIV].

When the lines and the background noise have commensurate magnitude: “cases commonly occur where both the background noise process and the line components are independently coherent, but, because their cross-spectra have different phases, their sum appears incoherent”

### 1.2 Coherence and Time Delay Estimation

Main points:

1. Compares tapering (Blackman-Tukey), WOSA, and lag-window smoothing (Carter and Nuttall).
2. Expressions for bias and variance of MSC estimates are given in Table 1, 2.
3. Bias due to rapidly changing phase “Koopmans [koopmans] notes that if the phase angle of the cross power spectrum is a rapidly varying function of frequency at the frequency that the coherence is to be estimated, the estimated coherence (in particular, MSC) can be biased downward to such an extent that a strong coherence is masked”

Rapidly changing phase may be due to a misalignment or lag of  $D$  time units and duration  $T$ . Carter calculates the bias in this case. For example, if  $1 D/T = 0.25$ , the expected value of the estimated MSC is about one-half of its true value.

**Note 1** [carter87] is a review paper on coherence estimation cited by [tc91] which has many citations. It references [lee83] which is the first jackknifing of coherency.

## References

- [carter87] G. C. Carter. “Coherence and Time Delay Estimation”. *Proceedings of the IEEE* 75 (1987), pp. 236–255.
- [koopmans] L. H. Koopmans. *The Spectral Analysis of Time Series*. Second. New York: Academic Press, 1995.
- [lee83] J. C. Lee. “On bias reduction in estimation of the magnitude-squared coherence function”. *Bull. of Informatics and Cybernetics* 20 (1983), pp. 107–114.
- [t82] D. J. Thomson. “Spectrum estimation and harmonic analysis”. *Proceedings of the IEEE* 70.9 (1982), pp. 1055–1096.
- [tc91] D. J. Thomson and A. D. Chave. “Jackknifed error estimates for spectra, coherences, and transfer functions”. In: *Advances in Spectrum Analysis and Array Processing*. Ed. by Simon Haykin. Vol. 1. Upper Saddle River, NJ: Prentice-Hall, 1991. Chap. 2, pp. 58–113.

## 2 Meteorology Papers

### 2.1 smith2006theory

This is a book on mesoscale atmospheric phenomena [smith2006theory].

### 2.2 einaudi1981interaction

This is a case study from a 300m tower where they had oscillations near 2-6 minutes [einaudi1981interaction].

### 2.3 finnigan1981interaction

This guy goes with the above [finnigan1981interaction].