Exercise 4 of Assignment 6 (due 2/20/08)

Suppose an investigator plans to collect a time series that can be modeled by a stationary process with an SDF shown in Figure A6–4 on the next page (note that, for $0 \le f \le 1 = f_{(N)}$, the SDF $S(f)$ is plotted versus f on a linear scale rather than a decibel scale). The investigator proposes to use the Parzen lag window spectral estimator.

(a) What kind of data taper would you recommend if the sample size N of the collected time series is 128? Would you change your recommendation if the sample size were increased to 1024? State the reasons for your recommendations.

(b) Would prewhitening be useful here? State the reasons for your answer.

(c) Determine the spectral bandwidth of $S(\cdot)$ by examining Figure A6–4. What does this imply about the size of the window bandwidth of the Parzen smoothing window? For the data taper(s) you selected in part (a) for sample sizes of $N = 128$ and 1024, determine what values of m (if any) would achieve the desired window bandwidth. Determine the corresponding equivalent degrees of freedom ν for both sample sizes.

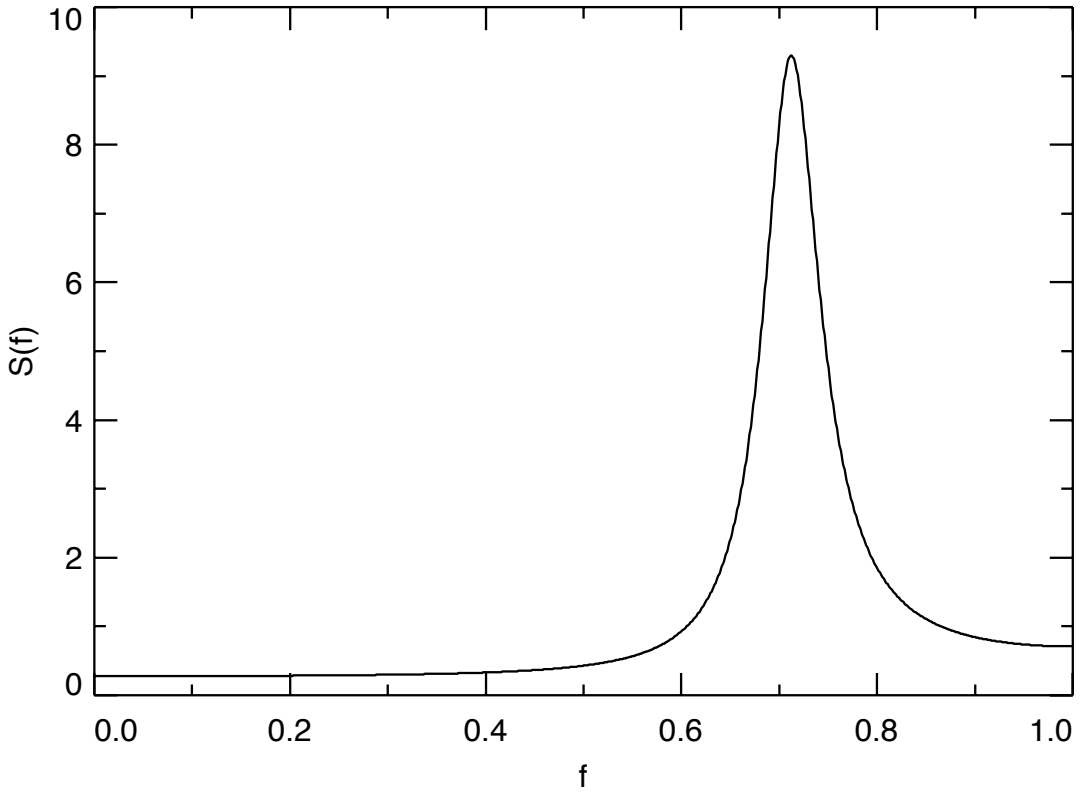

Figure A6–4. Hypothesized SDF. Note that $S(f)$ is plotted versus f on a linear/linear scale, not on the usual linear/decibel scale.