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subplot(421); stem(n, x); title('x(n)');
subplot(423); stem(n, w); title('w(n)');
subplot(422); stem(l_xx, r_xx); title('r_{xx}(l)');
subplot(424); stem(l_ww, r_ww); title('r_{ww}(l)');
subplot(425); stem(l_xw, r_xw); title('r_{xw}(l)');
subplot(426); stem(l_wx, r_wx); title('r_{wx}(l)');
subplot(427); stem(n, y); title('y(n)=x(n)+w(n)');
subplot(428); stem(l_yy, r_yy); title('r_{yy}(l)');

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### 3.4 Exercises

1. Plot an amplitude modulated signal, sampled by 1 MHz, whose carrier is of 100 kHz and modulation signal of 10 kHz, for a modulation index  $m = 1.2$ . Graph on the same figure, but in a different pane the suppressed carrier amplitude modulated sequence.
2. From all sequences obtained after sampling analog sinusoidal signals by 50 kHz, which one has the major variation?
3. Generate 101 samples of a sequence obtained from an analog sinusoidal signal sampled by 1 kHz; the analog sinusoid has unitary amplitude, zero phase and a frequency of 100 Hz.
  - From the previous sequence generate a full-wave rectified sequence;
  - Perform the arithmetic mean of the previously obtained sequences;
  - Graph the three sequences in the same figure, but in different panes.
4. Consider an analog sinusoidal signal with frequency 200 Hz. This signal is sampled by 800 Hz. Plot the analog signal, the discrete-time sequence obtained after sampling and the analog signal that can be recovered from samples ( $F_{\text{sim}} = 8$  kHz).
5. Consider the analog sinusoidal signals with the frequencies: 300 Hz, 400 Hz, 500 Hz, 700 Hz, and 900 Hz, respectively. All of them are sampled by 900 Hz. Plot the analog sinusoidal signals, the sequences obtained after sampling, the analog signals that can be recovered from samples and also the corresponding spectra. Is there any alias error? Why?
6. Let us consider a discrete-time signal  $y(n) = x(n-2) + w(n)$ ,  $n = \overline{0, 200}$ , where  $x(n) = 3 \cos(2\pi 0.15n) + 2 \cos(2\pi 0.1n)$ ,  $n = \overline{0, 200}$  and  $w(n)$  is an additive noise. By performing the autocorrelation of  $y(n)$  determine if  $x(n)$  is periodic or not. If yes, which is the period?