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% gda11_04
% supports Figure 11.6
% simple 1D backprojection example
% the relationship d(x) = L m(x) is "inveted"
% using the back-propagation approximation m=L'd
% (where L' is the adjoint of L).  In this
% example, L is the integral from 0 to x, Linv
% is the first derivative, and its adjoint is the
% integral from infinity to x

% independent variable x
M=201;
Dx=1.0;
x = Dx*[0:M-1]';
xmax=max(x);

% true model
sigma=12;
sigma2=sigma^2;
xbar1 = 3*xmax/8;
xbar2 = 5*xmax/8;
f1=1.0;
f2=2.0;
mtrue = sin(f1*x).*exp(-((x-xbar1).^2)/(2*sigma2)) + sin(f2*x).*exp(-((x-xbar2).^2)/(2*sigma2)
mtrue=mtrue-mean(mtrue);

% data is integral of model
dobs = Dx*cumsum(mtrue);

% plot true model
figure(1);
clf;
subplot(3,1,1);
set(gca,'LineWidth',3);
set(gca,'FontSize',14);
hold on;
axis( [0, M, min(mtrue), max(mtrue) ] );
plot( x, mtrue, 'k-', 'LineWidth', 3 );
xlabel('x');
ylabel('m');

% exact solution is m = Linv d
% where Linv the derivative operator d/dx
mest1 = diff(dobs)/Dx;

% plot exact solution
subplot(3,1,2);
set(gca,'LineWidth',3);
hold on;
axis( [0, M, min(mest1), max(mest1) ] );
plot( x(1:end-1), mest1, 'k-', 'LineWidth', 3 );
xlabel('x');
ylabel('m');

% solution via backprojection
mest2 = flipud(Dx*cumsum(flipud(dobs)));

% plot back-projected solution
subplot(3,1,3);
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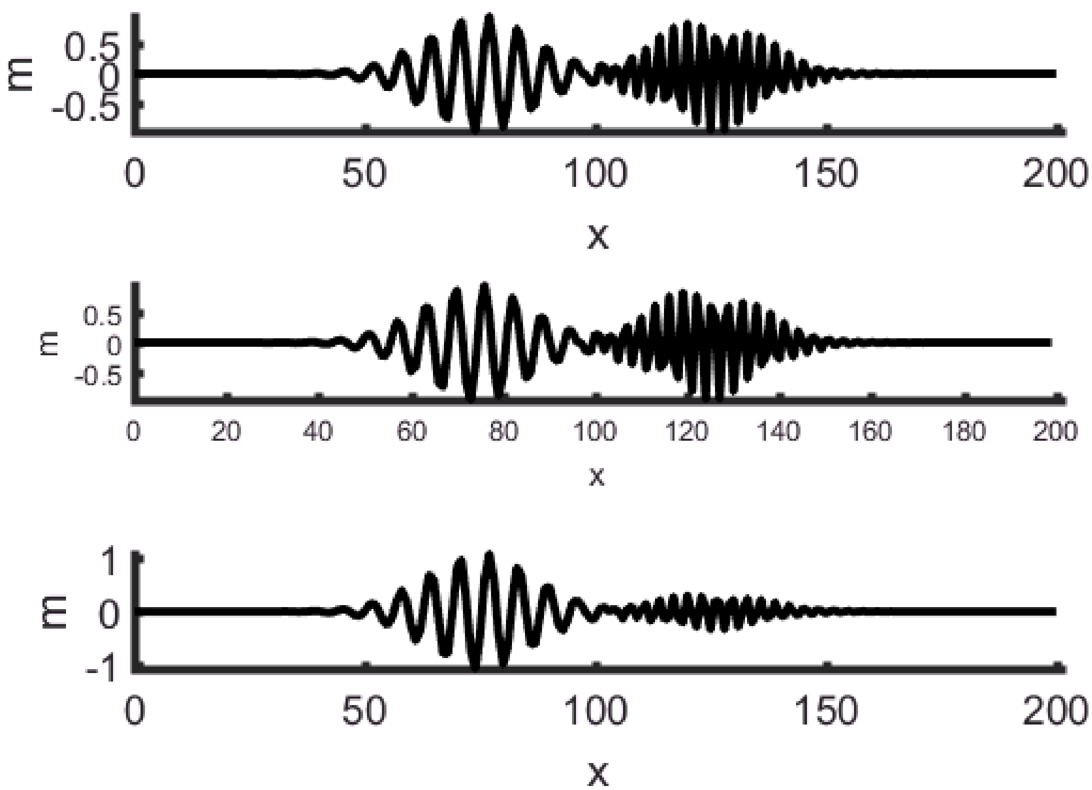
```
set(gca,'LineWidth',3);
set(gca,'FontSize',14);
hold on;
axis( [0, M, min(mest2), max(mest2) ] );
plot( x, mest2, 'k-', 'LineWidth', 3 );
xlabel('x');
ylabel('m');
```

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% Figure 11.6 (A) True one-dimensional model mtrue(x). The data satisfy dobs = ℒmtrue, where ℒ
% the indefinite integral. (B) Estimated model, using mest = ℒ- 1 dobs where ℒ-1 is the first d
% Note that mest = mtrue. (C) Backprojected model m(1) = ℒ† dobs, where ℒ† is the adjoint of ℒ.
% up to an overall multiplicative factor, m(1) ≈ mtrue. MatLab script gda11_04.
```