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N_points = [1600, 6400, 25600, 102400];
ClockTime = [3, 10, 17, 95];
Steps = [100, 200, 400, 800];

C_vals = ClockTime ./ Steps;

p = polyfit(log10(N_points), log10(C_vals), 1);
alpha = p(1);
beta = 10^p(2);

%plotting
fig = figure('Color', 'w');
ax = axes('Parent', fig, 'Color', 'w', 'XScale', 'log', 'YScale', 'log');
hold(ax, 'on');

loglog(N_points, C_vals, 'rs', 'MarkerSize', 7, 'LineWidth', 1.5, ...
    'MarkerFaceColor', 'r', 'DisplayName', 'Measured Cost (C)');

N_fit = [min(N_points)/1.5, max(N_points)*1.5];
C_fit = beta .* (N_fit.^alpha);
loglog(N_fit, C_fit, 'b-', 'LineWidth', 2, 'DisplayName', sprintf('Fit (\\
alpha = %.2f)', alpha));

xlabel('Total Grid Points (N)', 'FontSize', 12, 'FontWeight', 'bold',
'Color', 'k');
ylabel('Time per Step (C) [s]', 'FontSize', 12, 'FontWeight', 'bold',
'Color', 'k');
title('Computational Complexity Analysis', 'FontSize', 14, 'Color', 'k');

grid(ax, 'on');
grid(ax, 'minor');
ax.GridColor = [0.3 0.3 0.3];
ax.MinorGridColor = [0.6 0.6 0.6];
ax.GridAlpha = 0.5;
ax.MinorGridAlpha = 0.5;

xlim([min(N_points)/2, max(N_points)*2]);
ylim([min(C_vals)/2, max(C_vals)*2]);
ax.XColor = 'k';
ax.YColor = 'k';

lgd = legend('Location', 'northwest');
lgd.Color = 'w';
lgd.TextColor = 'k';
lgd.EdgeColor = 'k';

fprintf('Exponent alpha is: %.4f\n', alpha);

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