The Instantaneous Trendline

AfTA

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Philosophical Background

- **Technical Analysts must model the market to attack it**
  - **Ellioticians**
  - **Patterns**
  - **Fibanacci**
- **My models are based on a variant of the Random Walk**
- **My models consist of a Trend Mode and a Cycle Mode**

Diffusion Equation

- **"Drunkard's Walk" is a special form of the random walk problem**
  - **The drunk flips a coin to determine right or left with each step forward**
  - **The random variable is direction**
- **The Diffusion equation is the solution**
  - **describes smoke coming from a smokestack**
- **The smoke plume is analogous to market conditions**
  - **Breeze bends the plume to an average trendline**
  - **Plume widens with distance - distant predictions are less accurate**
  - **Smoke density is analogous to prediction probability - the best estimator is the average**

Telegrapher's Equation

- **Modify the "Drunkard's Walk" problem**
  - **Coin flip decides whether the drunk will reverse his direction, regardless of the direction of the last step**
  - **The random variable is now momentum, not direction**
- **Solution is now the Telegrapher's Equation**
  - **Describes the electric wave on a telegraph wire**
  - **Also describes a meandering river**
- **A river meander is a short term cycle**
  - **Random probability exists (Diffusion Equation) <u>IF:</u>**
    - Individual meanders are overlaid
    - Or a long data span is taken

The Market is Similar to a Meandering River

- **Both follow the path of least resistance**
- **Market Forces (greed, fear, profit, loss, etc.) are similar to physical forces, producing paths of uniform resistance.**
- **Think about how the masses ask the question:**

Will the market change?

OR

Will the trend continue?

Establishing Market Modes

- **Historically, I have measured the cycles and subtracted the Cycle components from the total to find the Trend**
- **Tonight, I will parse the two modes directly by filtering**
- **You will also see a successful trading strategy developed**
- **The Trend and Cycle components will be compared**

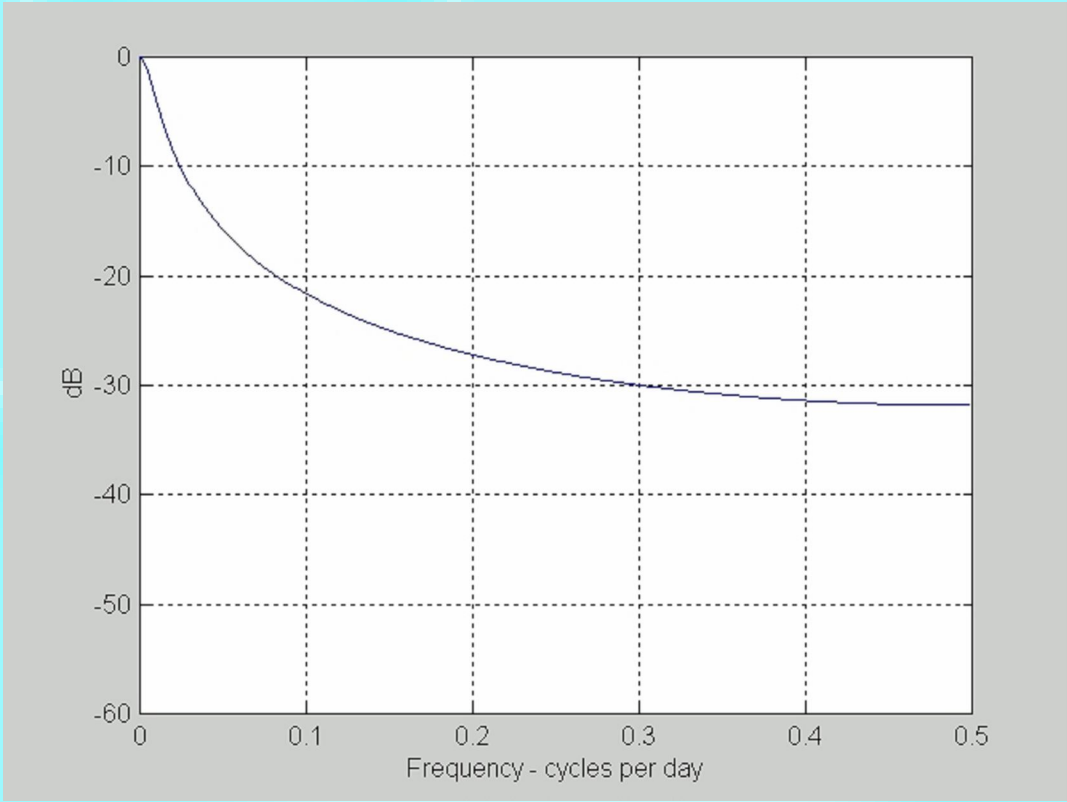
Exponential Moving Average

In EasyLanguage notation

Output = α*Input + (1 - α)*Output[1];

Using Z Transforms:

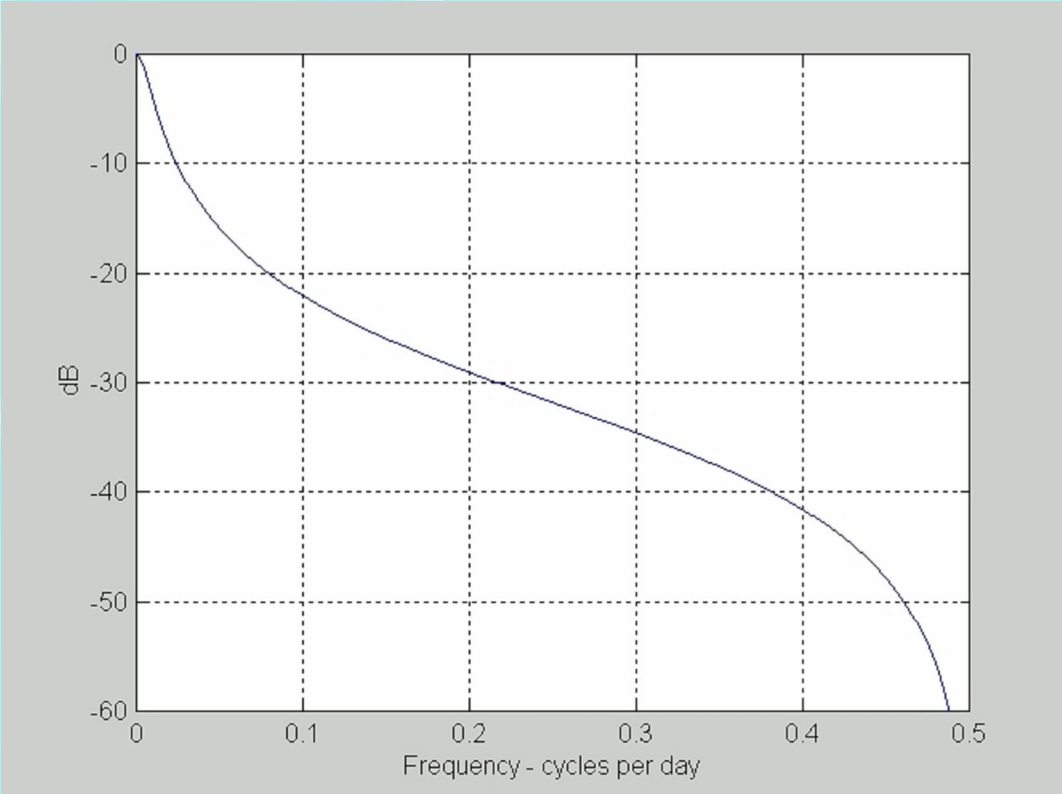
$$H(z) = \frac{Output}{Input} = \frac{\alpha}{1-(1-\alpha)*Z^{-1}}$$



Improved Attenuation

Averaging over 2 samples dramatically improves attenuation

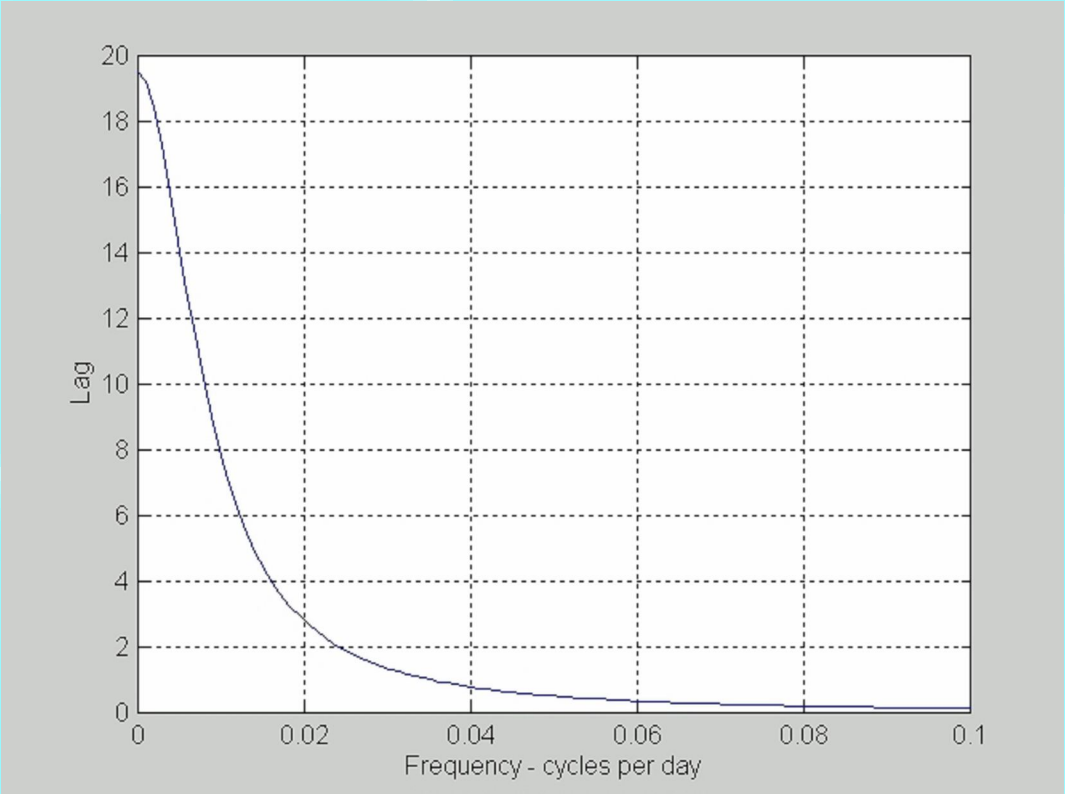
$$H(z) = \frac{\frac{\alpha}{2} * (1 + Z^{-1})}{1 - (1 - \alpha) * Z^{-1}}$$



Moving Average Lag

Lag of Moving Averages is the enemy of technical analysts

$$\alpha = \frac{2}{Length + 1} \qquad \alpha = \frac{1}{Lag + 1}$$



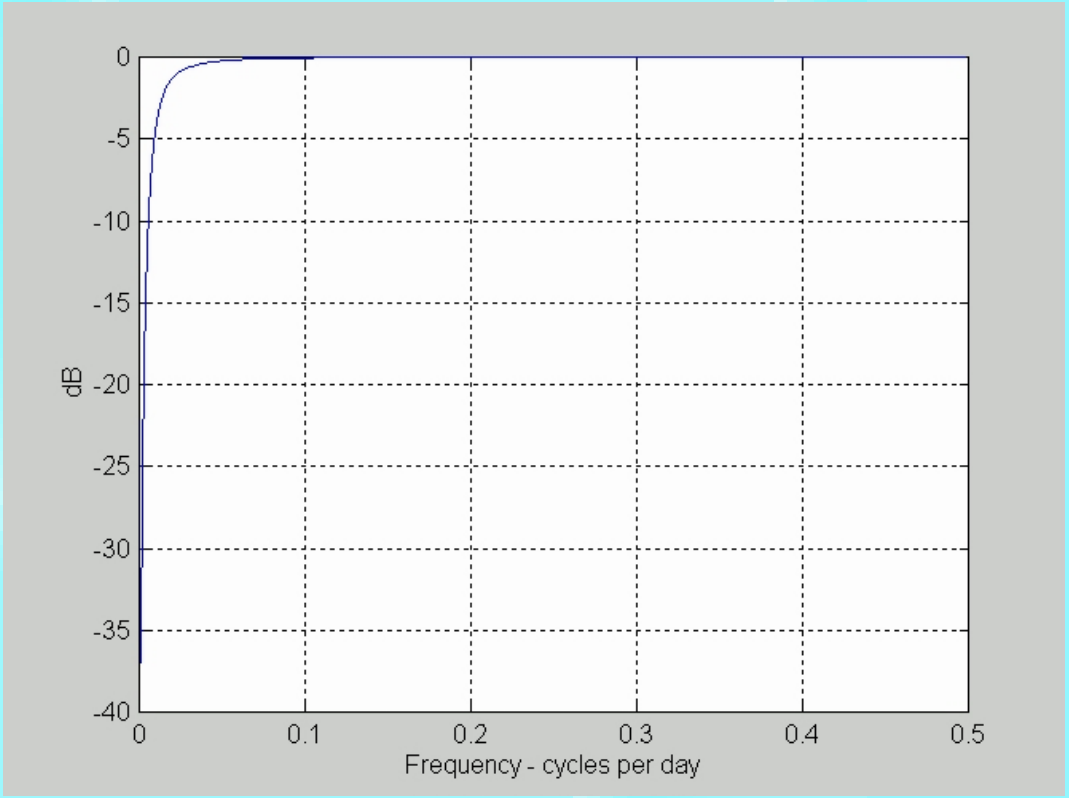
High Pass Filter Removes the Trend

Create by subtracting EMA Trend from an Allpass (unity)

$$HP(z) = 1 - \frac{\frac{\alpha}{2} * (1 + Z^{-1})}{1 - (1-\alpha) * Z^{-1}}$$

$$= \frac{1 - (1-\alpha) * Z^{-1} - \frac{\alpha}{2} * (1 + Z^{-1})}{1 - (1-\alpha) * Z^{-1}}$$

$$= \frac{(1 - \frac{\alpha}{2}) * (1 - Z^{-1})}{1 - (1-\alpha) * Z^{-1}}$$



Square to improve sharpness

$$HP(z) = \frac{(1 - \frac{\alpha}{2})^2 * (1 - 2 * Z^{-1} + Z^{-2})}{1 - 2 * (1-\alpha) * Z^{-1} + (1-\alpha)^2 * Z^{-2}}$$

In EasyLanguage notation:

HPF = $(1-\alpha/2)^2$*(Price – 2*Price[1] + Price[2]) + 2*$(1-\alpha)$*HPF[1] – $(1-\alpha)^2$*HPF[2];

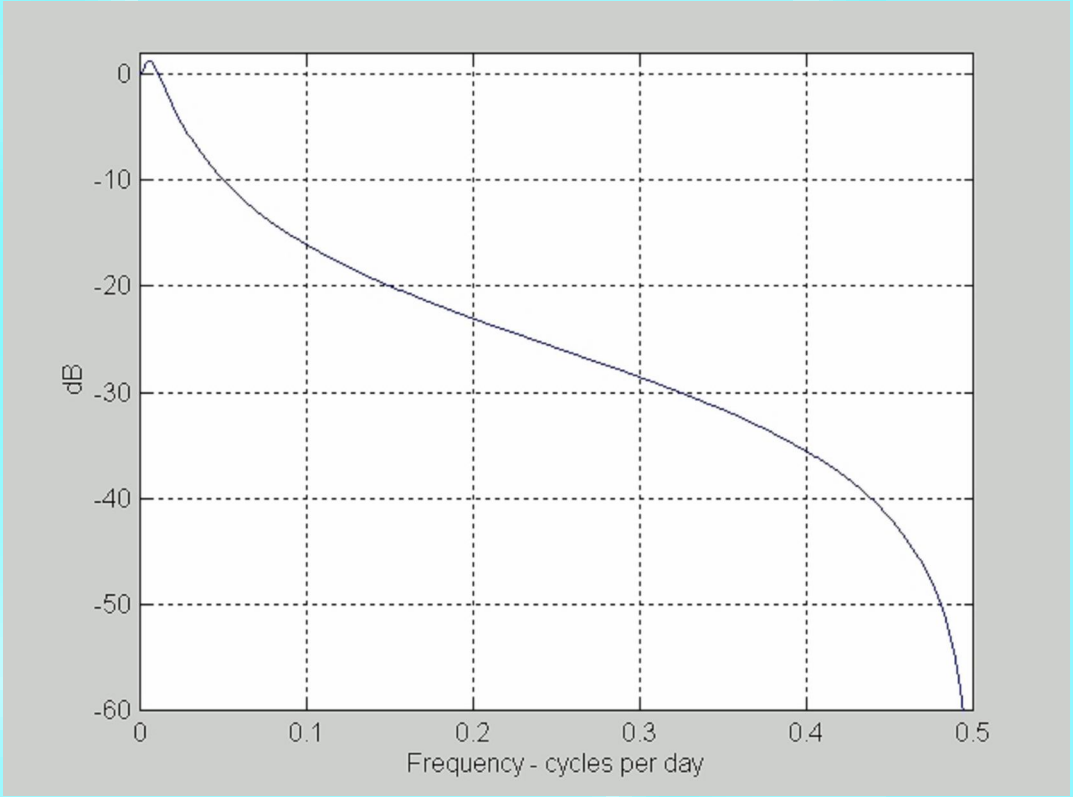
Instantaneous Trendline

Created by subtracting the High Pass Filter (Cycle Mode) from an Allpass

Attenuation is similar to an EMA

Skipping the algebra:

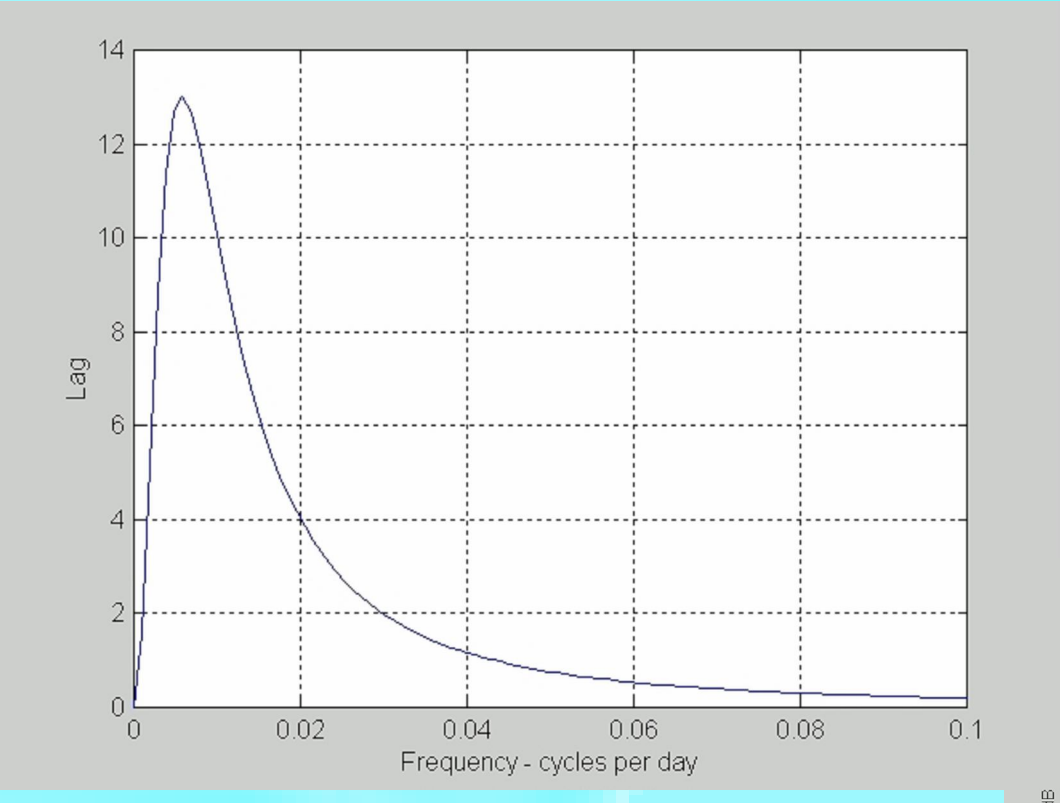
$$IT(z) = \frac{(\alpha - \frac{\alpha^2}{4}) + \frac{\alpha^2}{2} Z^{-1} - (\alpha - \frac{3\alpha^2}{4}) Z^{-2}}{1 - 2*(1-\alpha)*Z^{-1} + (1-\alpha)^2 Z^{-2}}$$

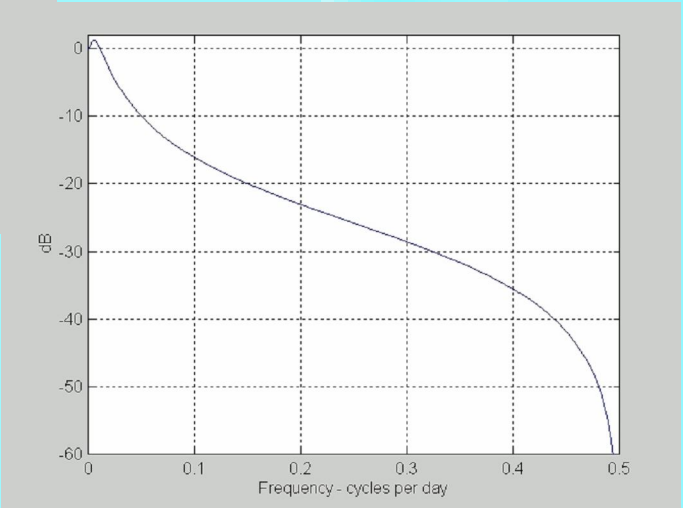


In EasyLanguage:

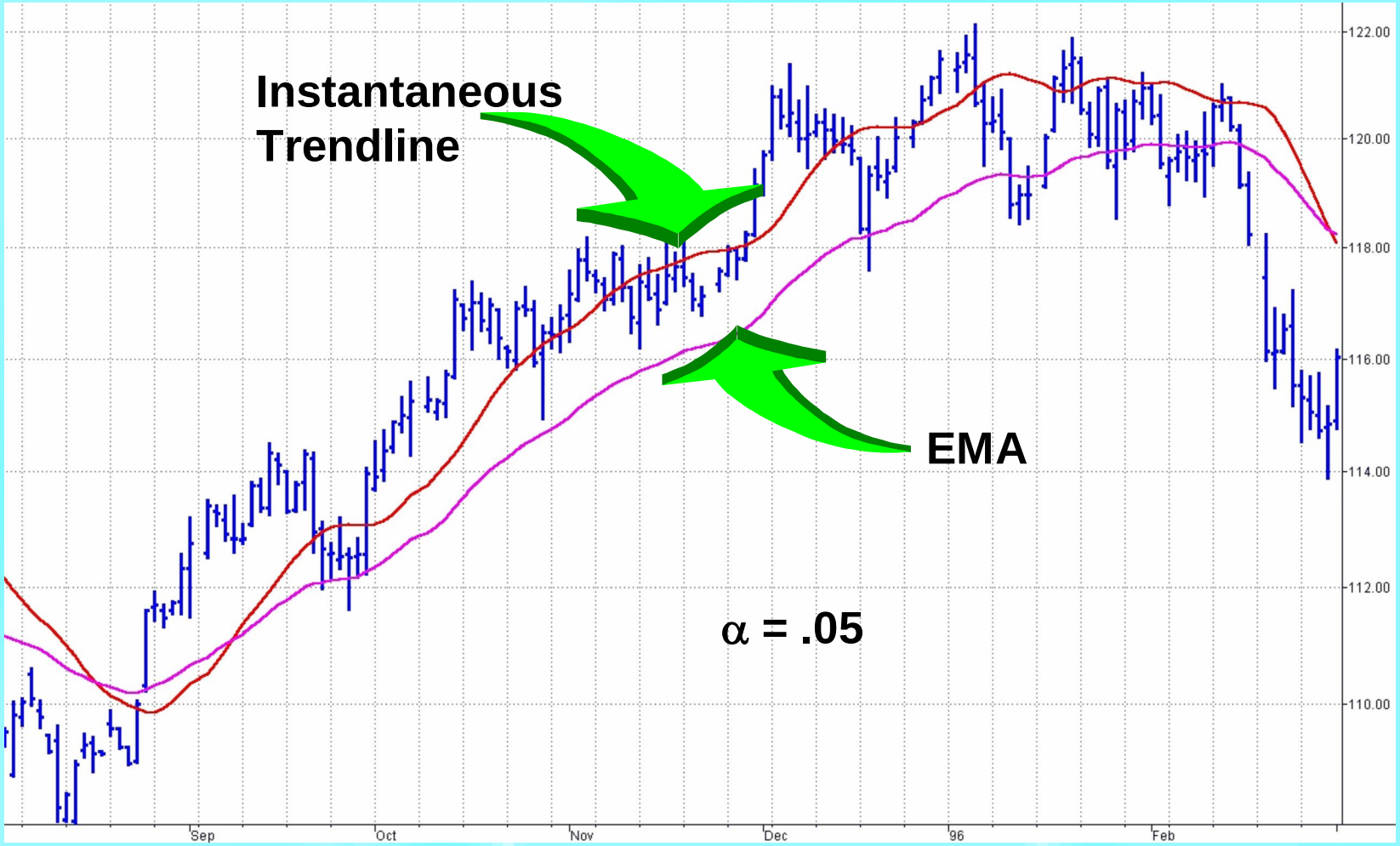
InstTrend = (α-(α/2)^2)*Price + (α^2/2)*Price[1] – (α – 3α^2/4)*Price[2]) + 2*(1-α)*InstTrend[1] - (1-α)^2*InstTrend[2];

Zero Frequency Lag is Removed



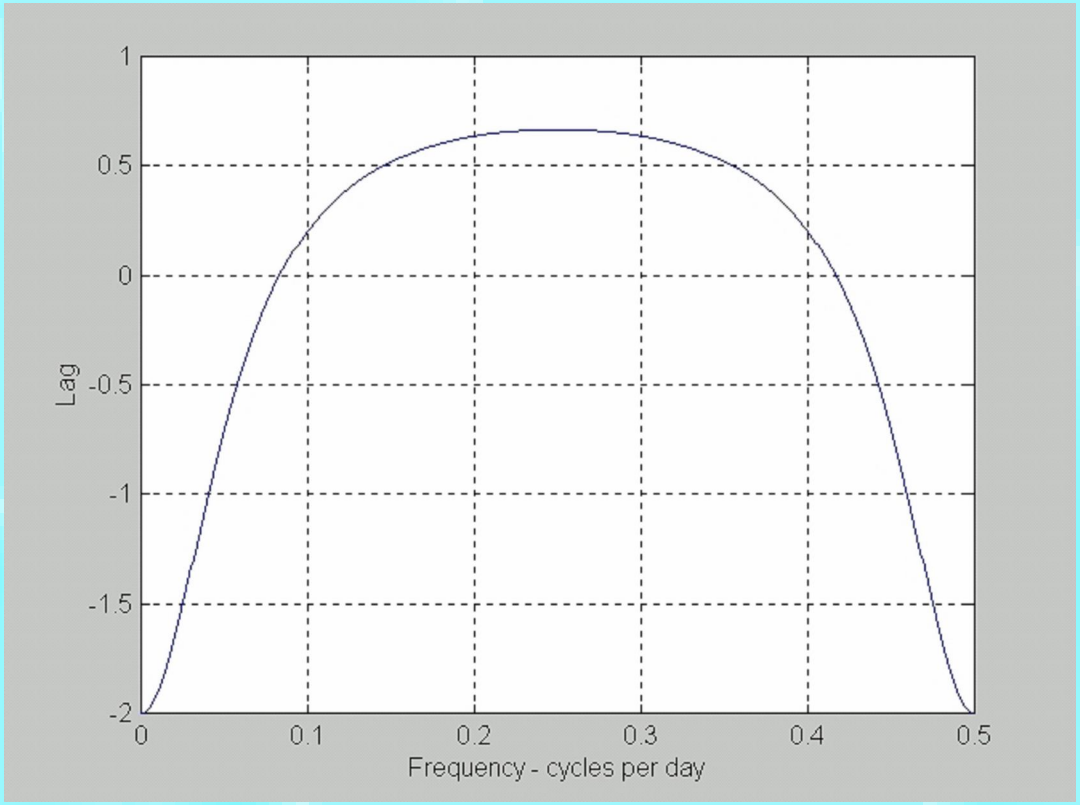


Instantaneous Trendline - EMA Comparison

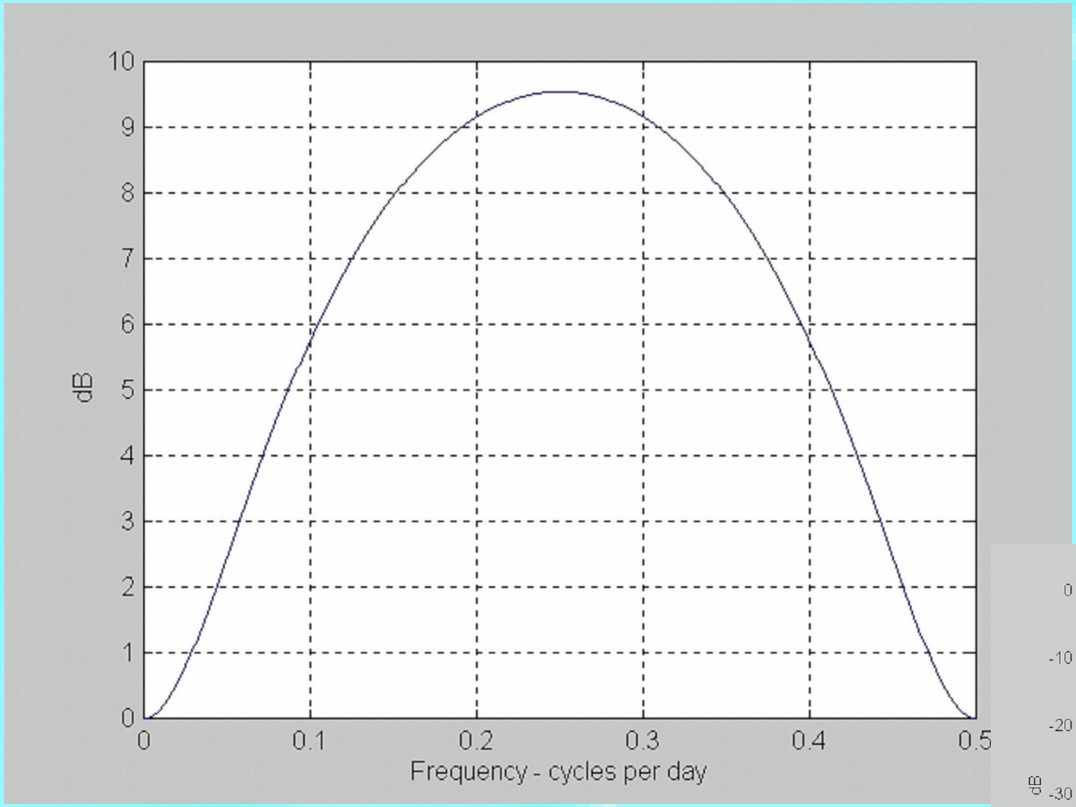


Trading Needs a Leading Signal

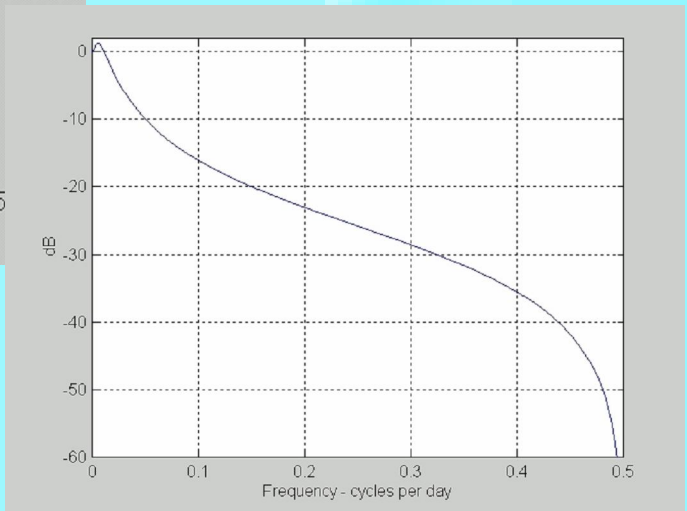
Add a 2 day momentum to the Instantaneous Trendline to get a 2 bar lead



Momentum Advancing Comes with a Penalty



Nearly a 10 dB filter gain for a 4 bar cycle



Gain is unimportant to the Instantaneous Trendline because it has a 25 dB attenuation at a 4 bar cycle

Simple Instantaneous Trendline Strategy

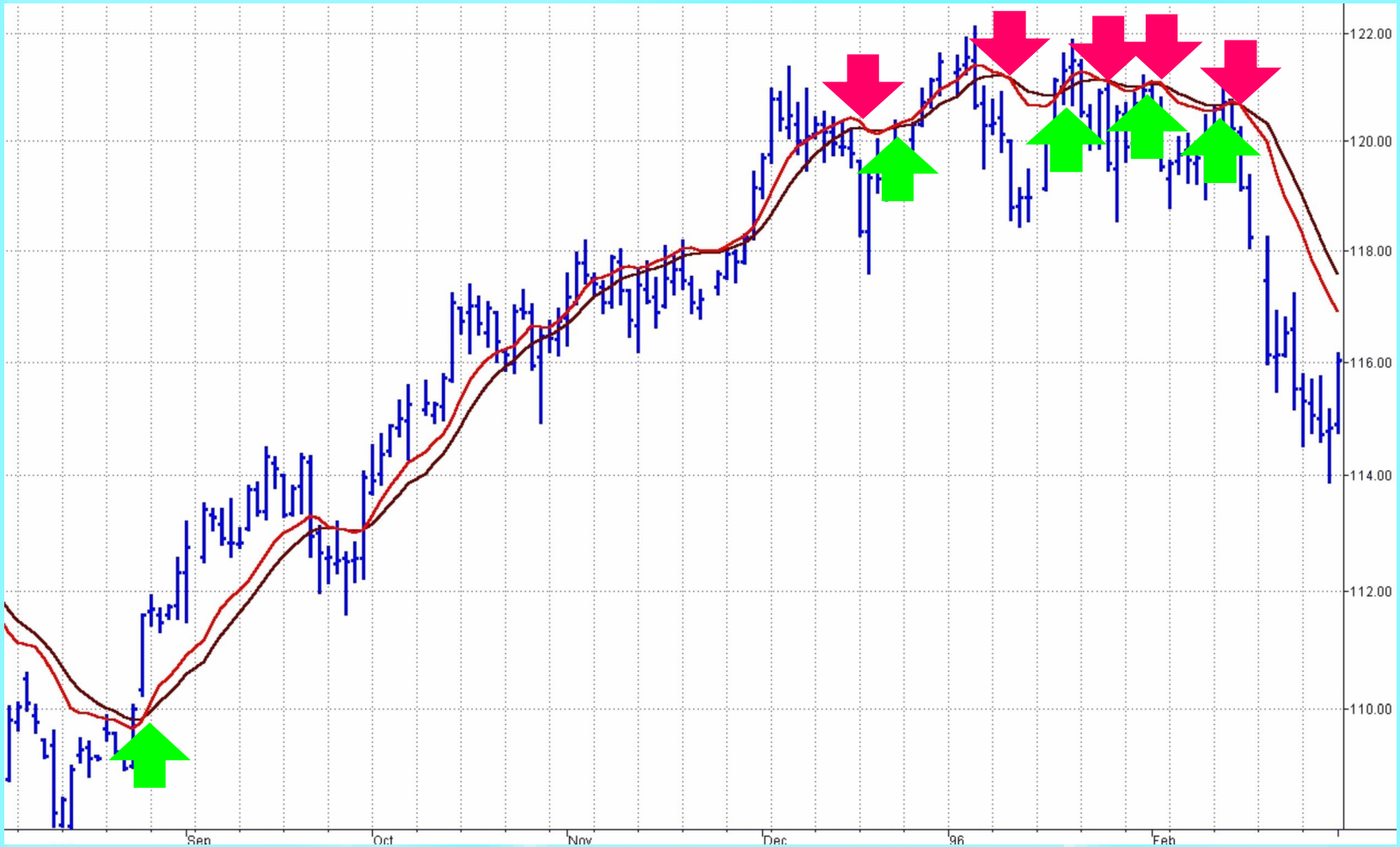
```
Inputs:         Price((H+L)/2),
                alpha(.07);

Vars:           Smooth(0),
                ITrend(0),
                Trigger(0);

ITrend = (alpha - alpha*alpha/4)*Price + .5*alpha*alpha*Price[1]
        -   (alpha - .75*alpha*alpha)*Price[2] + 2*(1 - alpha)*ITrend[1]
        -   (1 - alpha)*(1 - alpha)*Itrend[2];
If currentbar < 7 then ITrend = (Price + 2*Price[1] + Price[2]) / 4;
Trigger = 2*Itrend - ITrend[2];

Plot1(Itrend, "ITrend");
Plot2(Trigger, "Trig");
```

Strategy Trades on Line Crossings



Practical Strategy Enhancements

1) **Buy/Sell on a limit after the price has gone against the anticipated position by a factor related to current volatility**
2) **Provide reversal if market has an adverse excursion**

```
Inputs:     Price((H+L)/2),
            alpha(.07),
            RngFrac(.35),
            RevPct(1.015);

Vars:       Smooth(0),
            ITrend(0),
            Trigger(0);

ITrend = (alpha - alpha*alpha/4)*Price + .5*alpha*alpha*Price[1]
       -  (alpha - .75*alpha*alpha)*Price[2] + 2*(1 - alpha)*ITrend[1]
       -  (1 - alpha)*(1 - alpha)*ITrend[2];
If currentbar < 7 then ITrend = (Price + 2*Price[1] + Price[2]) / 4;
Trigger = 2*Itrend - ITrend[2];

If Trigger Crosses Over ITrend then Buy at Close - RngFrac*(High - Low) Limit;
If Trigger Crosses Under ITrend then Sell Short at Close + RngFrac*(High - Low) Limit;

If MarketPosition = 1 and Close < EntryPrice/RevPct then Sell Short Next Bar On Open;
If MarketPosition = -1 and Close > RevPct*EntryPrice then Buy Next Bar on Open;
```

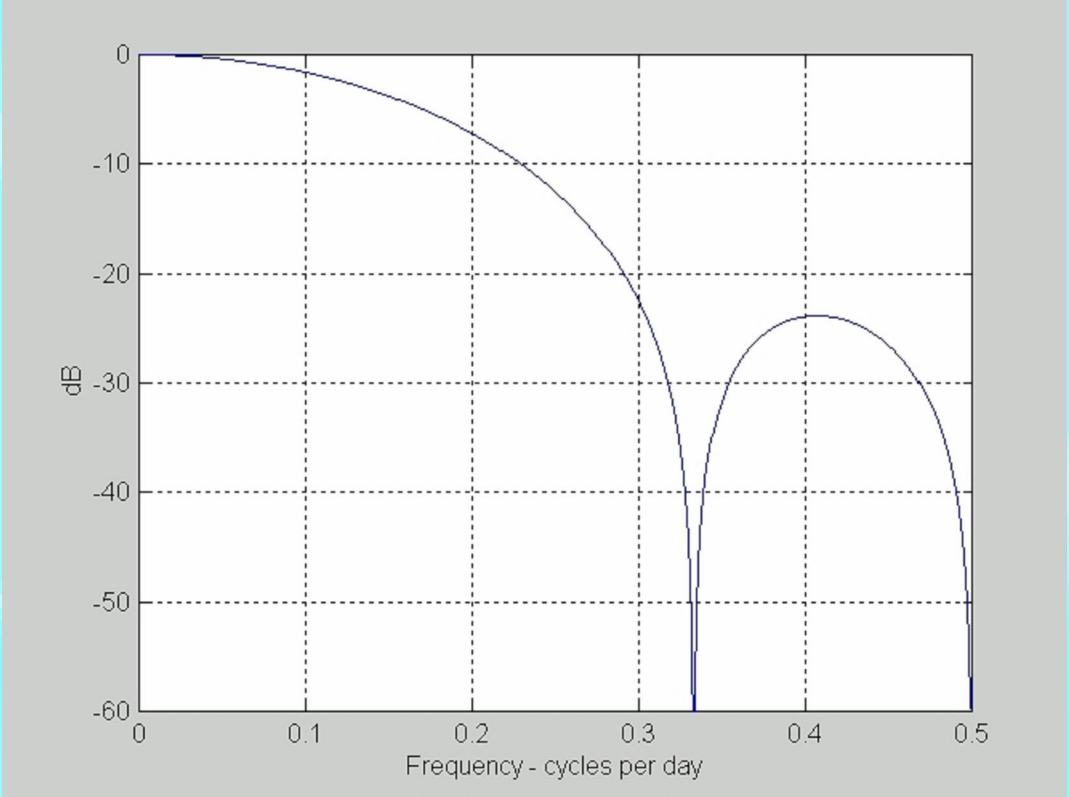
Results Are Comparable to Strategies Costing $1000 Or More

Future	Net Profit	# Trades	% Profitable	Profit Factor	Max DD
EC (4/81 – 3/03)	$201,812	230	42.2%	1.89	($26,775)
JY (9/81 – 3/03)	$221,312	229	48.5%	2.50	($11,712)
SF (6/76 – 3/03)	$129,175	337	45.1%	1.52	($15,387)

A Low Lag Smoothing Filter

In EasyLanguage notation:

Smooth = (Price + 2*Price[1] + 2*Price[2] + Price[3]) / 6;



Used to remove the high frequency content of the High Pass Filter

A Simple Cycle Indicator

```
Inputs:     Price((H+L)/2),
            alpha(.07);

Vars:       Smooth(0),
            Cycle(0);

Smooth = (Price + 2*Price[1] + 2*Price[2] + Price[3])/6;
Cycle = (1 - .5*alpha)*(1 - .5*alpha)*(Smooth - 2*Smooth[1] + Smooth[2])
        + 2*(1 - alpha)*Cycle[1] - (1 - alpha)*(1 - alpha)*Cycle[2];
If currentbar < 7 then Cycle = (Price - 2*Price[1] + Price[2]) / 4;

Plot1(Cycle, "Cycle");
Plot2(Cycle[1], "Trigger");
```

The trading indicator is when the Cycle Component crosses itself delayed by one bar

Cycle and Trend Mode Indicators are Complementary

A low lag smoothing line crossed the Instantanteous Trendline at the same time the Cycle crosses zero - THIS IS A FIRST!

SUMMARY

- **You have learned how to create an Instantaneous Trendline (Zero Lag)**
- **You have a trend-following trading strategy comparable to commercial strategies**
- **You have an excellent Cycle Mode indicator (an oscillator)**
- **You understand how profound a philosophical model of the market can be**