Problems with TEMA

© Malcolm Moore
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The Treble EMA (TEMA)

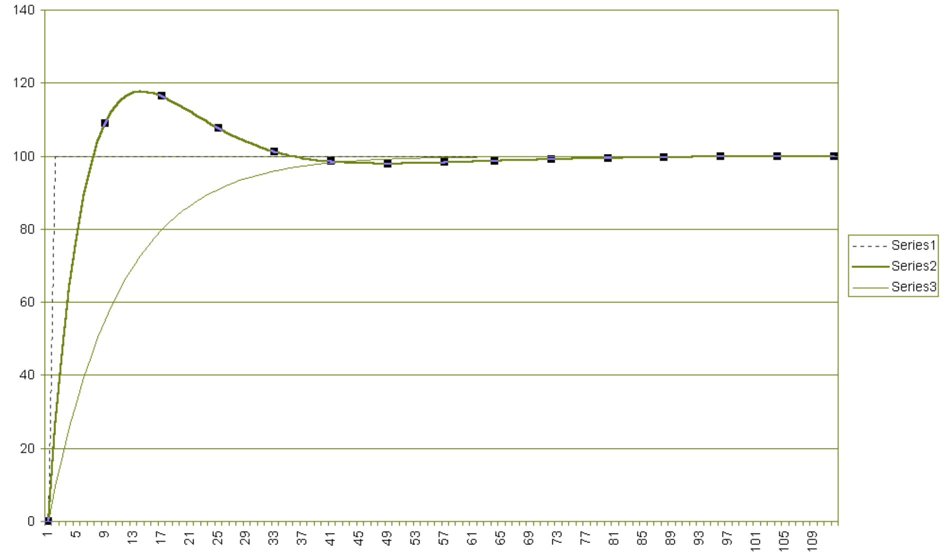
The Triple Exponential Moving Average (TEMA) and this has the basic formula of:

TEMA = 3 * EMA(Price, Period) - 3 * EMA(EMA(Price, Period), Period)

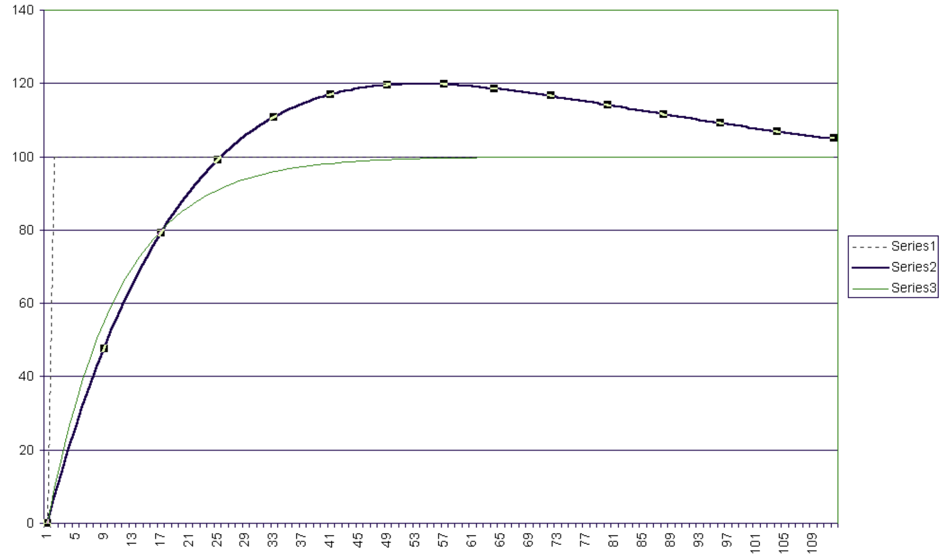
+ EMA(EMA(EMA(Price, Period), Period), Period

Or to put it more simply: TEMA = 3EMA1 - 3EMA2 + EMA3

To start with a clinical view basing the exponentials on 20 periods, and use a reference as before of EMA20, the graph below shows the TEMA20_20_20 and it clearly has an ugly overshoot then a slight undershoot before finally settling.

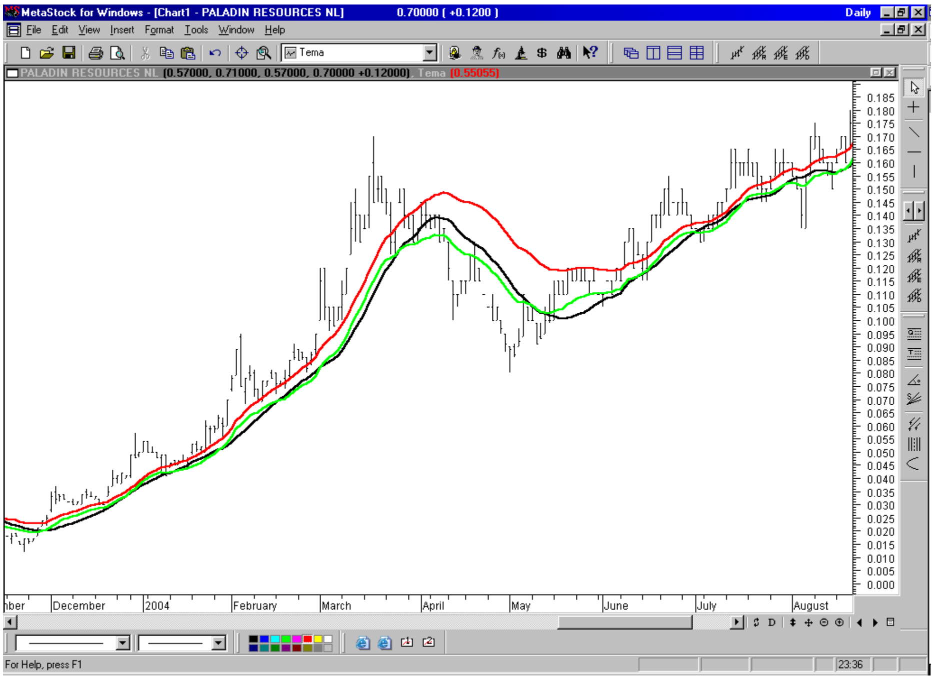


To normalise this to the EMA20 the TEMA needs to be considerably slowed down to TEMA82_82_82 and this is shown below:



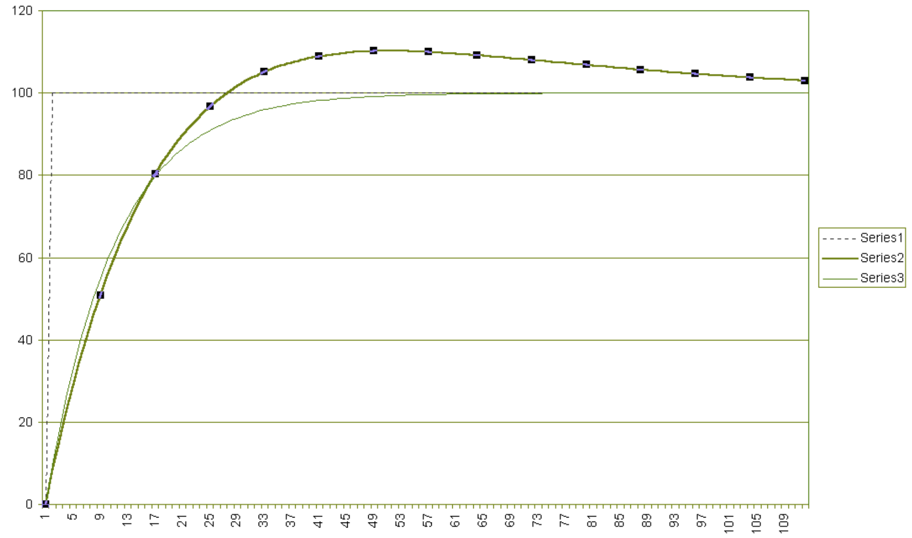
This response is seriously ugly, and we can use EOD graphs to realise that the overshoot of about 20% will cause turns to be missed, even though the TEMA20 may well hug the trend (but we know that the comparative time constants are not right!

The timing on this graph needs to be normalised by 4.1 times to make it align with the EMA20 and SMA20 as shown below:

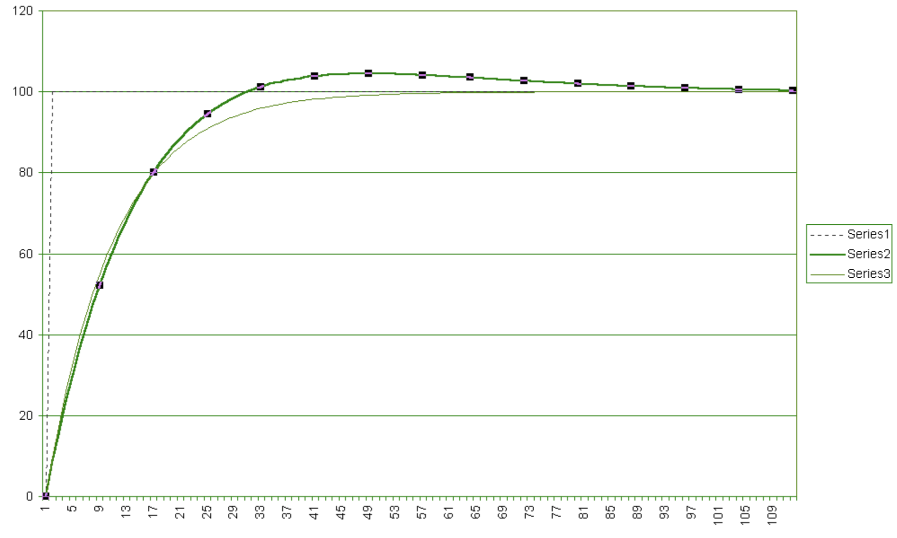


Again, the TEMA just like the DEMA has the time constants misaligned and that is why it “appears” to be so effective. By normalising the TEMA by 4.1 time constants, then the right hand graph shows the aligned responses and the problem caused by the excessive and lengthy overshoot. It does however hug a trend very closely because the subtraction of the differential from the initial EMA, minimising its error to a ramp excitation.

With our simple knowledge of the exponentials in this equation, it is possible to try for some transient responses that are not so underdamped. We can get the overshoot down to about 10% by setting the exponentials at TEMA72_53_38 as shown immediately below:

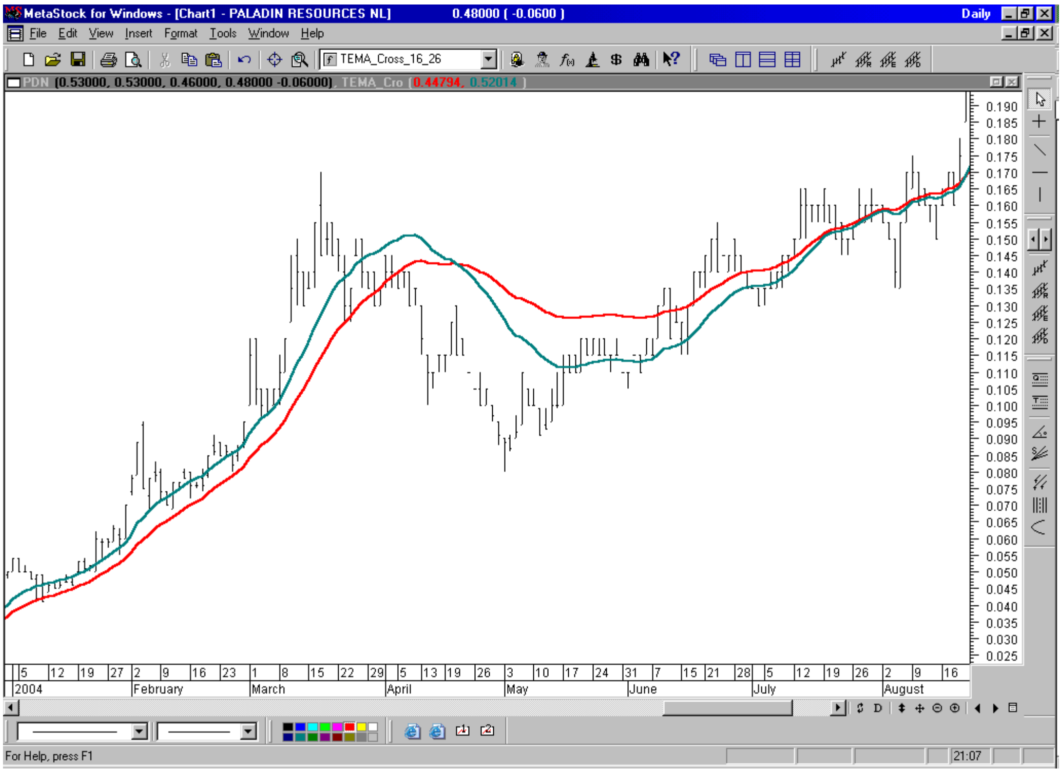


We can then go for about 5% overshoot with a TEMA68_45_36 as shown on the graph below:

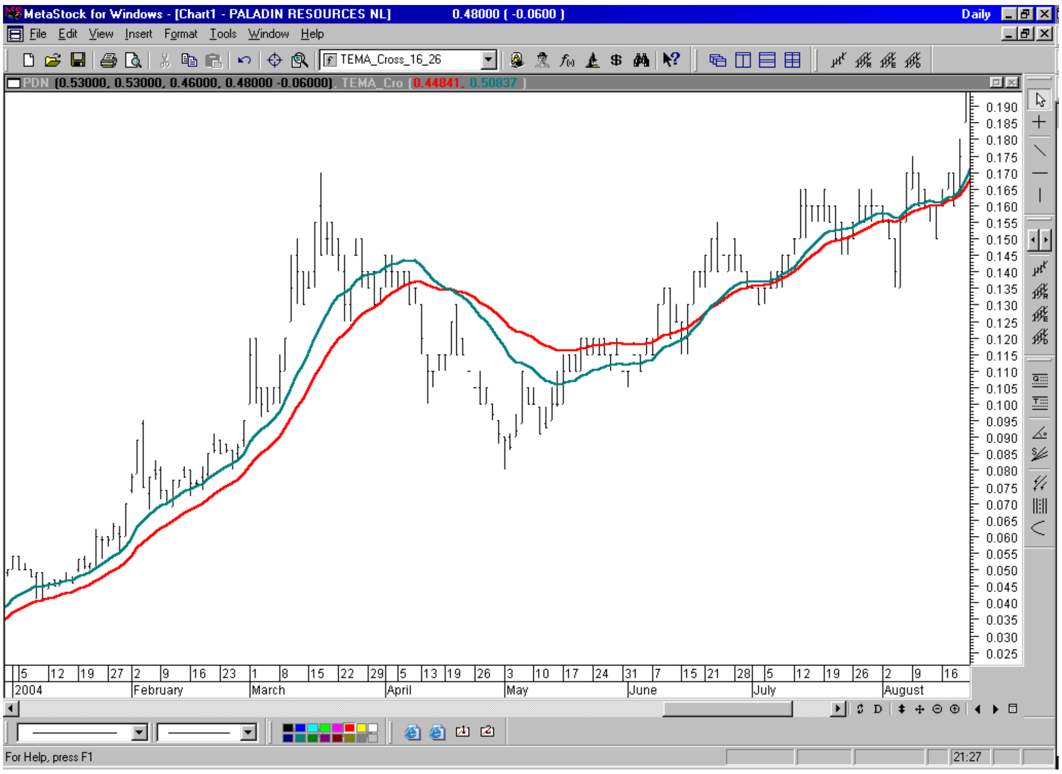


But look a little closer, as we pull the overshoot back to a critically damped situation we also end up almost overlaying the EMA20 as shown below on the left with the TEMA64_38_32 and it now should be very clear that this is really a no-win situation! After all, we did the same with the DEMA40_21 and it too, went nowhere!

To get a handle on the TEMA, and see what happens in real life, the old EMA16, EMA26 pair was constructed using TEMA66_66_66 and TEMA107_107_107, and these were put onto an EOD graph, below and clearly the overshoot with its tail spells nothing short of a disaster!



The faster TEMA crosses over late and then takes far too long to recover and has a very smeared set of crossings, which is bad for trading applications.



By choosing a TEMA with a 10% overshoot, modified as before by selecting the different successive exponential rates, and then normalised to match the 16 / 26 alignment, the new constants are TEMA58_42_30 and TEMA94_69_49, and the results are in the above graph.

It is not a pretty sight, even though the overshoot and trailing tail has been significantly reduced, it is not as good as an un-tampered EMA16 / EMA26.

Come in Spinner!

From what I can understand of it, both the DEMA and TEMA were apparently made to give quicker results - but when normalised the true nature of thee responses becomes apparent. In both cases the DEMA and TEMA have an ugly overshoots from a clinical step response and this is not plainly clear when used in a ramp situation.

Beyond the step and ramp edge both these derived filter functions have extended tails that cause their moving average values to swing out and on when the prices change direction, and in every case the crossovers of two moving average traces is impinged by these dragging exponential tails. To compound matters the DEMA and TEMA were never normalised and consequently they appear to be acting faster but are not!

By changing the coefficients of the moving averages in the sum, to form the DEMA and TEMA it is shown that as the overshoot and tail are minimised, the end result is identical to a first order EMA filter - so we are back where we started from!

In all cases the EMA is a better choice to date, and the SMA is a more conservative moving average indicator than the EMA in most cases. There are alternative approaches to improving the transient response of an EMA!

Comments and Corrections are welcome