Work in Progress on application of dynamic systems theory to the A series (2)

Choice of software.

For much of this work it was found that the Macey & Oster program "Berkeley Madonna (8.3.11)" (Note #1) provided a simple way to give models of real situations and I used this sytem rather than "Stella (3.0.7)" which is rather similar, and has an excellent written instruction handbook (in Hannon (1997)) and numerous example. Stella was used occasionally too, but the models are nearly interchangeable in practice here. Another model I gave careful consideration to using was the G.A. Korn program "Desire", but most of what we wanted to do so far seems possible in Berkeley Madonna. The copy of Desire which I obtained did not come with the Windows distribution. I do in fact have a running Linux box, but as the work had been done so far in Windows it was decided not to use the rather more complex but possibly more flexible Desire at this time. One point of note was that inverse Fourier transforms, for example, if required can be obtained from the quite flexible Algebrus, which is readily available as a Windows program. For much of this work Windows 98SE has been adequate to date.

Madonna, like Stella, has the advantage that the actual models simulated are produced at the time the program is prepared, rather than just leaving us with a lot of algebra to report.

Discussion

Madonna makes it very easy to simulate numerous possible models for a system and it is essential to choose one best for the needs of the time. I have tried a great many models and find that a very simple conscious (waking) / unconscious (dreaming) model can give quite good results.

This model is referred to as **N003b**.

In this model shown in N003b diag.clp (see Note #4 to find graphs and equations) the unconscious mind (Romeo) is R and the conscious mind (Juliet) is J. The equations N003b equns.rtf can be substituted into Berkeley Madonna.

Further elaborations are briefly noted later in this piece.

Now this model works well for descriptions of precognitive dreams, using the Sprott (2004) values for a hermit Romeo and an eager beaver Juliet. (Note #2)

For Stickgold (postcognitive or Tetris) dreams we need to vary values slightly from the (Sprott, 2004) values of Note #2 which as mentioned below correspond to a 'hermit' Romeo and an 'eager beaver' Juliet. In fact the example graph [N003b graph S a -1.99 c 1.01 d 1.017.bmp] or in brief N003b graph S.bmp uses a slightly more enthusiatic Juliet (with c increased from Sprott's value 1 to 1.01 and d increased from 1 to 1.017) and a slightly less introverted Romeo (with a decreased from -2 to -1.99). e is also varied from the standard value of 1 down to a lower value of 0.6 which permits postcognition (or for these values almost simultaneous cognition which could be lowered further if appropriate).

Now this seems to be a fairly good model to be going on with, and the relative positions of red and black lines with respect to each other can fluctuate by parameter change.

Some slightly different models, including one with some random elements in R to simulate random dream effects, are mentioned in Note #3.

Stickgold's results and my extensions to them

Stickgold's dream creation results devolve around the fact that it appears that we have two different memory systems. The hippocampus codes information on events from our lives. The findings suggest that the brain does not go to the hippocampus to get images for dreams, but to the long-term, neocortical system. Stickgold uses evidence like the fact that in one series of experiments, three amnesic patients with extensive bilateral medial temporal lobe damage produced similar hypnagogic reports to the control sample despite being unable to recall playing the game, suggesting that such imagery may arise without important contribution from the declarative memory system.

I set up a preliminary model M002 (see Note #4) which contains a representation of a sleeping mind (R), a waking mind (J) and a perturbation (Z) (or 'Tetris or ski-ing game') and the details and parameters need to be filled in and/or added to or altered to give flesh to the model.

Then a large number of other models and parameter sets were tried (Note #3) and mainly we used N003b as stated.

A few neurological details as to obtaining choice of model

A Kahn and Hobson (1993) proposed the use of a simple Verhulst equation model as a starting point. In their equation (2) they formally visualise x as the density of images in a dream report and t as the time. This gives

$$dx/dt = ax - x*x$$

or in a more advanced form,

$$d\, x_t = (\alpha * x_t - x_t * x_t) * dt + F * x_t * dW_t$$

where alpha is described by equation (4) of Kahn (1993) as an 'average value', x_t is the stochastic variable and W_t the Wiener process (that is, the basic process of Brownian motion).

B Clearly, remembering and forgetting could be two important features of a model. The second Christos (Christos (1996), Goertzel (1997)) experiment, which uses the Crick-Mitchison (1983) hypothesis (or some similar credible approach) to produce a Hopfield net which (unlike a properly trained Hopfield) produced some positive results.

Sprott (2007) used tanh functions for his neural net model of the logistic map and the same approach could be tried for further work on Christos's problem. Goertzel also has looked at this aspect of the topic of dreams in great detail.

C Flor (1998), for example, uses a simple log-linear model to give the operation of the brain.in terms of task response times.

$$RT(t) = k * t ^ b$$

where RT is task response time, t is the time and k and b are constants. This seems to me to be more or less rather like the use of the common Stephens' formula.

D Hannon (1997) mentions stochastic resonance effects in Chapter 16, and such effects can also be incorporated in a model and in fact I did so in the slightly more complicated SR003A which includes some aspects of the Hannon model in the Romeo or dreaming state. In common with results for many cases where modelling is made slightly more complicated but requires more parameters, so far this does not seem to have really paid off at this level of model making. It might be a way forward at a later date however.

E FitzHugh-Nagumo models. Izhikevich (2007) has a large page of publications, some devoted primarily to the FHN effect and Hasegawa (2006) had a lot of articles both in citebase and in the condensed-matter archive arXiv relating to the FHN and the neocortex and indeed small-world results. I found Sailer's (2007) dissertation contained a useful summary of some of the recent work. Hannon (1997) Chapter 11 outlines how it can all be done but the current situation is pointed out in models like that in section D above (SR003A) I have done just a little introductory work here. Use of more known physical parameters over a range might help, perhaps somewhat along the lines of the way Kahn (1993) approached the matter.

F It may be a good idea to differentiate between the forms of our R and J, so it could mean altering the model so that we may for instance want a Hobson and/or Christos style of model for R and say a Flor model for J. And then to get the parameters using bang-bang or Pontryagin method. This complexity has so far not been needed and I tend, by analogy, to look at the realtively high success of the very simple early Kuramoto models and at the fact that later models seem to add more problems for the number of concrete results obtained., admittedly not inconsiderable in some cases.

Results from Model N003b
N003b is tbe model considered most appropriate so far.

N003b equns.rtf are the Berkeley Madonna equations for a very simple model.

The diagram N003b diag.clp shows how it works and it is displayed on the graph. Anyone with a Java enabled copy of Berkeley Madonna can reproduce this system and easily vary parameters.

The small green line on N003b graph.bmp describes a simple impulse or blip, to represent for example a Tetris game, and it is on the same sale as R. The black and red lines are respectively Romeo (call it unconscious mind, dreaming mind or what you will - no complex neurology system or pseudoscientific patter is necessarily implied by the term) and Juliet (conscious) - R and J are both in the same brain.

The a and b values of -2 chosen for Romeo (unconscious mind) are the 'hermit' values (Sprott, 2004). The Juliet values of unity for c and d are the 'eager beaver' values (Sprott, 2004). This suggests that the conscious mind is eager to look and to interact and the unconsious mind appears more like a hermit, (which may well have hidden depths of course). The two of course do interact and in the present model the blip is only supposed to interact with the unconscious mind, or in a dream if we like. These are preliminary choices only to keep in line with earlier work. In fact it was not found that substantial variations from these reasonable choices do much more than add parameters unless there are clear reasons to do so.

N, M and P of course just confirm the there is a real pulse or blip at around time 31, affecting an otherwise blank or 'normalised' mind in the way shown on the graph.

As e is raised from a value of unity through 2 (as shown on the graph N003b e 2.bmp - similar notation for other graphs) to say 10, the time values of R and J peaks get lower and lower, until there are two series peaks for each on the graph, one being dream precognition peaks quite early and the other possible real peaks when the dream comes true. By the time e is 1000 and there is strong interaction, the main peaks occur 'at or around' the time of the pulse again.

Note that if we try e less than unity, at say 0.5 both R and J peaks rise to times later than the pulse. So clearly on this model the intensity of the pulse has to be finely adjusted to allow a 'precognition' effect.

The black line (the dream and/or unconscious mental impingence) rises just before the red line (the observed result) in time - which can be through direct observation or memory of the dream. By altering the parameters the extent of the black line's peak preceeding the red line's peak or vice versa can be altered. In fact in Fig 1 they are about equal, as in the case of a dream and its first physical recollection being almost simultaneous - clearly the various parameters allow fine tuning as to their relative positions.

At a zero value of e, there are still peaks at very high time values and these are probably simply explained by model interpretation, model crudity and butterfly effect. At e = 0 there is a very strong butterfly effect as can be readily seen by altering INIT R and INIT J by say 0.001 on this simple and illustrative model. This variation is very clear in an R v J (or phase diagram), and is extremely important here just at e = 0.To put it differently, in the A series if the past, present and future are laid out on the same time line like this, the past present and future may not map adequately onto a B series diagram, so at large times, or at otherwise anomalous times, we cannot expect such a model to necessarily be suitable. We might well feel therefore that in our pseudo A series model, in practice high large or anomalous peaks can fairly be disgarded though there is a mathematical reason for them to be there.

On the other hand for very large values of e, or very large interactions, the time values of R and J may not show very great anomalies at large times. In fact they may become rather pedestrian, as they seem to do here at e = 1000.

As pointed out above, if we try e less than unity, at say 0.5 both R and J peaks rise to times later than the pulse, and if e is very much larger than unity the results again seem pedestrian. So clearly on this model the intensity of the pulse interaction has to be finely adjusted to allow a 'precognition' effect. But on this model there is a reasonably wide range of interaction adjustment allowing us to obtain precognitive effects, not necessarily a single point "sweet spot" or cusp.

Conclusions

Up to a point the Dream postcognition model (Stickgold) (Figure 8) and the Dream precognition model (Yates) (Figure 1) speak for themselves. And we can also see that the interesting precognition effect can occur over a serious but possibly brief range of parameter values, as remarked above, and does not necessarily just refer to a singularity or a cusp. Also, the whole idea fits in well with the A series idea as essentially we are only considering a fragment or portion of the time of one individual, and his or her past/present/future.

There is clearly very much more to be said about the use and utility of such a model, which could lead to further awe-inspiring results and further experiments, possibly of a very targeted nature in terms of psychological environment. That is: We are not thinking of yet another general dream survey of the kind which we already have in large numbers, and which indeed are often useful and of great worth.

Much more mathematical explication may be advisable as well as more experiments. Both can occur together. There is a great deal of ongoing experimentation (for example in Garcia-Ojalvo (2004)) from many fronts and I am deeply impressed by the relatively easy blog of Harris (2007, and also 2007a) and likewise by the fine philosophical and psychological comments of Draaisma

(2000) also quoted with some approval in Harris's blog.

I will just conclude for the moment in pointing out the relatively easy use of Fourier transforms using the present type of model, perhaps directly or by using the Algebrus program (Note #1) and the possible easy relation of holographic models to the present model in this way. I give some brief but perhaps relevant and important details in Note #5 where I further indicate why the homunculus paradox in our model need not, even carefully bearing in mind Draaisma (2000) on that matter, be of any difficulty with the present approach.

Important Note

The appropriate graphs are essential and were posted, but anyone who cannot read them on this blog can get them from me by email or by post (normally Airmail from London, England).

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Harris (2007a), a wide range of often relevant papers can be found at http://www.cnel.ufl.edu/hybrid/publication_paper.htm, particularly for example his reference 9 Harris, Nicolelis et al "Ascertaining the importance of neurons to develop better brain-machine interfaces"

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Yates J., (2006), "Can dreams predict the future ?", http://ttjohn.blogspot.com/2006/04/do-we-dream-of-future.html ; and many other entries in this blog.

Notes

#1. Berkeley Madonna: http://www.berkeleymadonna.com/
Stella: http://www.iseesystems.com/ ; a very useful guide book for Stella and also helpful for Berkeley Madonna is Hannon & Matthias (1997)
Desire: Korn, G.A.: "Advanced Dynamic-system Simulation: Model Replication and Monte Carlo Simulation", Wiley, New York, 2007.
Algebrus: http://www.astrise.com/software/algebrus/

#2. Specifically this is the model described in equation (4) of Sprott (2004).page 310. Calculations with the slightly simpler model (1) seem ultimately to lead to similar overall conclusions.

#3. **SR003A**
This includes a random factor during the dream. It does not improve our results technically so far. There are more parameters, not just e but f,k1,k2,k3,F2.

This one has both R and J involved and even e = 100 does not seem to move the pulse much from a sort of 31 on R and J - this is with f = 5

It did not seem to make much difference anywhere f was between +50 and -50and eventually tried e over +100 to -100

So both R and J are involved - but there is not much that is not pedestrian.

Other working notes for a few models are mentioned in this note (Note #3) and it all could be expanded on in a later essay - if there seems need to.

A001btempnew This actually seem to give a meaningful result at only about f = 81 (like e = 81 effectively) and no precog. effect. It also included more terms like a sine wave and a random term in R an a cusp effect. But the pulse was only on J which seems to be one source of less interest for the model, whilst the random (or dream) effect was on R.

N003a which had not connection whatever to the pulse and n e term, also had butterfly like behaviour for small INIT J and INIT R but a good behaviour for slightly larger INIT values, say over 0.001 each i.e. The existence of the pulse does not seem to determine other characteristics than that conncerned with the pulse itself - and we should keep away from very high and very low times on the model, probably.

There were many other models tried including **A001**, **SR003**, **SR002**, **M004**.

#4. ***Captions to diagrams, and equation details:***

Figure 8 DREAM POSTCOGNITION MODEL (Stickgold)
Figure 1 DREAM PRECOGNITION MODEL (Yates)

Figure 1 N003b graph e1
Figure 2 N003b graph e2
Figure 3 N003b e10 graph
Figure 4 N003b e1000 graph
Figure 5 N003b e0.5 graph
Figure 6 N003b e0.1 graph
Figure 7 N003b e 0 graph
Figure 8 N003b graph S a -1.99 c 1.01 d 1.017
Figure 9 SR003A graph
Figure 10 N003b diag
Figure 11 SR003A diag

N003b equns.rtf is the following:

These are the Madonna equations for a very simple model. The diagram shows how it works and it is displayed on the graph. Anyone with a Java enabled copy of Berkeley Madonna can reproduce this system and easily vary parameters.

The small green line describes a simple impulse or blip, to represent for example a Tetris game, and it is on the same sale as R. The black and red lines are respectively Romeo (call it unconscious mind, dreaming mind or what you will - no complex neurology system or pseudoscientific patter is necessarily implied by the term) and Juliet (conscious) - R and J are both in the same brain.

The a and b values of -2 chosen for Romeo (unconscious mind) are the 'hermit' values (Sprott, 2004). The Juliet values of unity for c and d are the 'eager beaver' values (Sprott, 2004). This suggests that the conscious mind is eager to look and to interact and the unconsious mind appears more like a hermit, (which may well have hidden depths of course). The two of course do interact and in the present model the blip is only supposed to interct with the unconscious mind, or in a dream if we like. These are preliminary choices only to keep in line with earlier work. In fact it was not found that substantial variations from these reasonable choices do much more than add parameters unless there are clear reasons to do so.

N, M and P of course just confirm the there is a real pulse or blip at around time 31, affecting an otherwise blank or 'normalised' mind in the way shown on the graph.

As e is raised from a value of unity through 2 to say 10, the time values of R and J peaks get lower and lower, until there are two series peaks for each on the graph, one being dream precognition peaks quite early and the other possible real peaks when the dream comes true. By the time e is 1000 and there is strong interaction, the main peaks occur 'at or around' the time of the pulse again.

Note that if we try e less than unity, at say 0.5 both R and J peaks rise to times later than the pulse.

At a zero value of e, there are still peaks at very high time values and these are probably simply explained by model interpretation, model crudity and butterfly effect. By e = 0 there is a very strong butterfly effect as can be seen by altering INIT R and INIT J by say 0.001 on this simple and illustrative model. To put it differently, in the A series if the past, present and future are laid out on the same time line like this, the past present and future may not map adequately onto a B series diagram, so at very large times, or at otherwise anomalous times, we cannot expect such a model to necessarily be suitable.

On the other hand for very large values of e, or very large interactions, the time values of R and J may not show very great anomalies. In fact they may become rather pedestrian, s they seem to do here.}

```
{Top model}

{Reservoirs}
d/dt (R) = + x1
INIT R = 0
d/dt (J) = + x2
INIT J = 0
d/dt (Z) = + x3
INIT Z = 0


{Flows}
x1 = a * R + b * J * (1 - ABS (J) ) + e * Z
x2 = c * R * (1 - ABS(R) )+ d * J
x3 = h * SQUAREPULSE (N,M) - h * SQUAREPULSE(N+ P,M) + h1 * SQUAREPULSE(N +
h2,M) -h1 * SQUAREPULSE(N+P+h2,M)

{Functions}
a = -2
b = -2
c = 1
d = 1
h = 0.1
h1 = -0.1
h2 = 1
N = 31
M = 1
P = 1
e = 1
{Globals}
{End Globals}
```

SR003A equns.rtf is the following :
{Top model}

{Reservoirs}
d/dt (R) = + dR
INIT R = 0
d/dt (J) = + dJ
INIT J = 0
d/dt (Z) = + dZ
INIT Z = 0

{Flows}
dR = a * R * (1 - R) + b * J + e* Z + TT * (1 + k3 * R)
dJ = c * R + d * J + f* Z
dZ = R1+g * R

{Functions}
S = h * SQUAREPULSE (N, M) - h * SQUAREPULSE(N + P, M) + P * 0
a = -1.8
b = -2
c = 1
d = 0.6
g = 0.8
e = 1
N = 31
M = 1
h = 2
P = 1
f = 0.1
k = 0
k1 = 0
k2 = 0.02
TT = k * RANDOM (k1,k2)
k3 = 1
V = 0
F1 = SIN (X1 * F2)
X1 = time
F2 = 5
V1 = 1
R1 = V * S + V1 * S * F1
{Globals}
{End Globals}

M002 equations are the following:
{Top model}

{Reservoirs}
d/dt (R) = + dR
INIT R = 0

d/dt (J) = + dJ
INIT J = 0
d/dt (Z) = + dZ
INIT Z = 0

{Flows}
dR = a * R + b * J + e* Z
dJ = c * R + d * J + f* Z
dZ = S+g * R

{Functions}
S = h * SQUAREPULSE (N, M) - h * SQUAREPULSE(N + P, M)
a = -1.8
b = -2
c = 1
d = 0.6
g = 0.8
e = 1
N = 31
M = 1
h = 2
P = 1
f = 0.1
{Globals}
{End Globals}

A001btempnew
{Top model}

{Reservoirs}
d/dt (R) = + dR
INIT R = 0
d/dt (J) = + dJ
INIT J = 0
d/dt (Z) = + dZ
INIT Z = 0

{Flows}
dR = a * R * (1 - R) + b * J + TT * (1 + k3 * R)+ k4 * R^3
dJ = c * R + d * J + f* Z
dZ = R1+g * R

{Functions}
S = h * SQUAREPULSE (N, M) {- h * SQUAREPULSE(N + P, M)} + P * 0
a = -1.8
b = -2
c = 1
d = 0.6
g = 0.8
N = 31
M = 1
h = 2

```
P = 1
f = 70
k = 0
k1 = 0
k2 = 0.02
TT = k * RANDOM (k1,k2)
k3 = 1
V = 0
F1 = SIN (X1 * F2)
X1 = time
F2 = 5
V1 = 1
R1 = V * S + V1 * S * F1
k4 = 1
{Globals}
{End Globals}
----------------------------------
```

#5. To do a fast Fourier transform of say R or J in Berkeley Madonna we just press F on the graph of R or J versus time, altering the scaling if desired (in Graph/Axis Settings/Scales) so we can see the frequencies more clearly. Then if we want to we can, say, remove from or add to the frequencies displayed and then do an inverse FT if desired, bearing in mind of course, the comments in Harris (2007) or Prideaux (2000) or for a current overall assessment Pribam (2007). We can also read Bohm & Hiley (1993). The intention is not to assume a holographic interpretation of the brain but the FTs and inverse FTs condition us to think of possible holographic type interpretations of our model, though of course we are not obliged to do so in terms of what we have said so far.

Draaisma (2000) points out the apparent possible relevance of the homunculus paradox to any holographic model or assessment in several places in his book, in particular on pp 156-7, 178, 212-18, 226-8. First I will point out that this fine book contains much philosophical comment, which by its nature demands constructive consideration. Briefly - and of course there is much more to say - mentioning his comments on p218 it seems to me that since each part of a hologram includes a total (though perhaps unclear) image (Prideaux (2000), Harris (2007)) so too if a truly complete image is said to actually include the homunculus, the homunculus will fade along with the image. So that an accurate representation which we give will include the homunculus.

For example if we take a somewhat Spinozan view of the universe, the total image of the moment of a person's consideration may well include the whole universe and this concept is possibly a good enough rough metaphysical expose - the metaphysics people often say things like this, it fits in well enough with the idea of the butterfly effect etc. Even though we aren't using it in the present study - and it is important to remember that we are not trying to write metaphysics and I feel that the homunculus concept tends to rather betray us into that field - it is probably not difficult to see how we could mathematically give a loose exposition through the work of Prideaux (2000) or even at a pinch Bohm (1993) - in fact a few weeks ago the idea was also independently brought to my mind during a popular lecture on Bohm at the Scientific and Medical Network, who often seem to deal with such rather outre ideas.

Given the result of the last paragraph, the model which we consider must inevitably be a rather faded and blurred hologram and we are downright lucky to have even that. In fact we are not likely to find the homunculus except as a blur somewhere in the diagram. So we can say "This is not like the story of the little Dutch girl holding a can with a picture on it of a little Dutch girl holding a can with a picture ..." to an undecipherable infinite regress - and you know even if it were, infinite regresses expressed as infinite series are not so bad in physics. But here there is, as far as I can see, no essential infinite regress anyway, and thus no homunculus problem implied or entailed. In physics it is almost a sad thing when a paradox is not there - we recall Zeno's paradox being said to be a precursor of the calculus and so on. But still, if a paradox is not there then it isn't, and that for the moment at least my own belief is that such an interpretation may quell homunculus paradox worries, even if we may be left with some even more inspired and oracular ideas in the painstakingly long run in considering, if we can and wish to, .holograms.

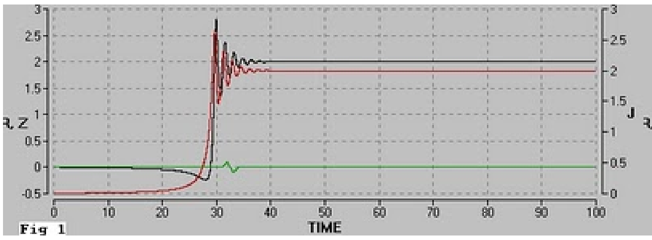

Fig 1

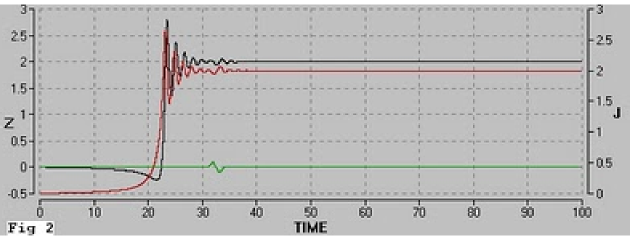

Fig 2

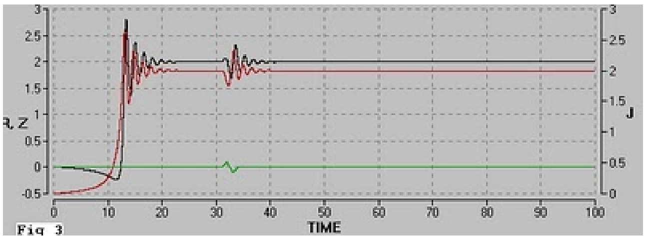

Fig 3

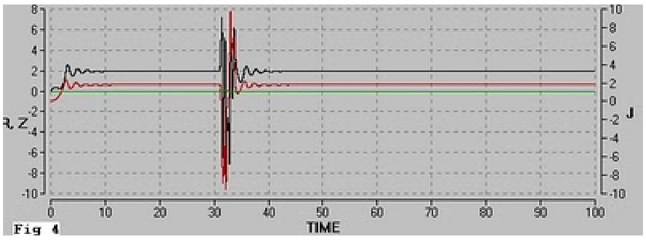

Fig 4

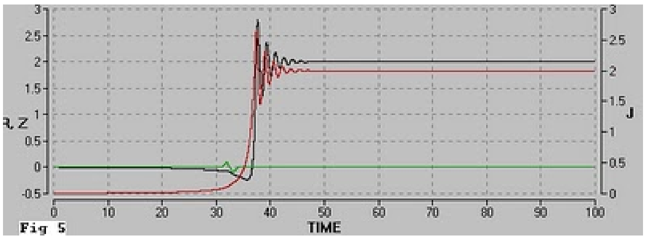

Fig 5

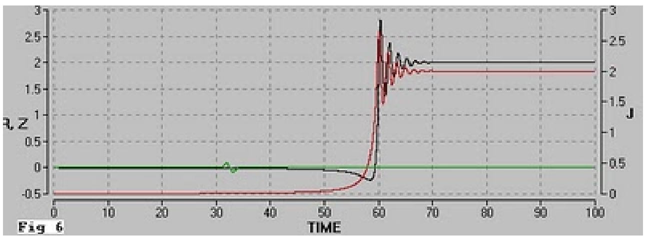

Fig 6

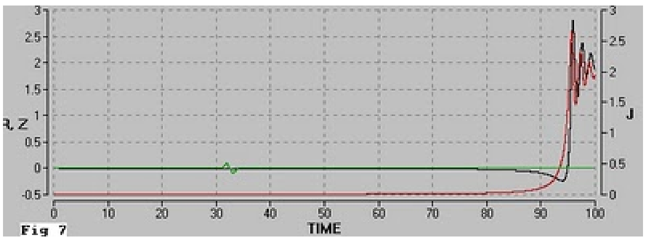

Fig 7

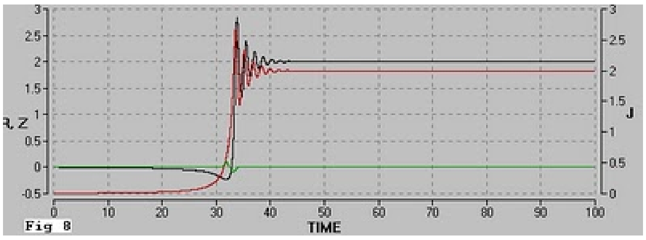

Fig 8

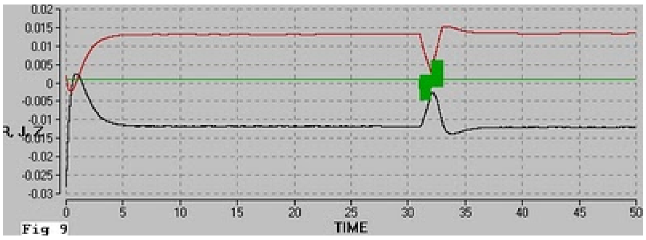

Fig 9

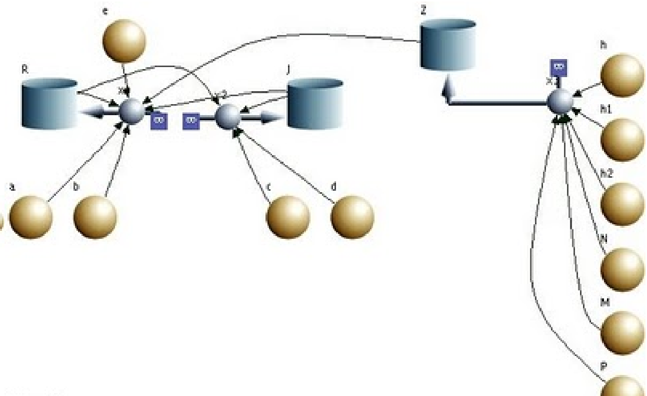

Fig 10

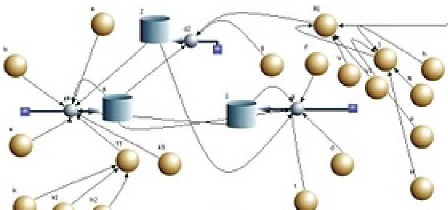
Fig 11