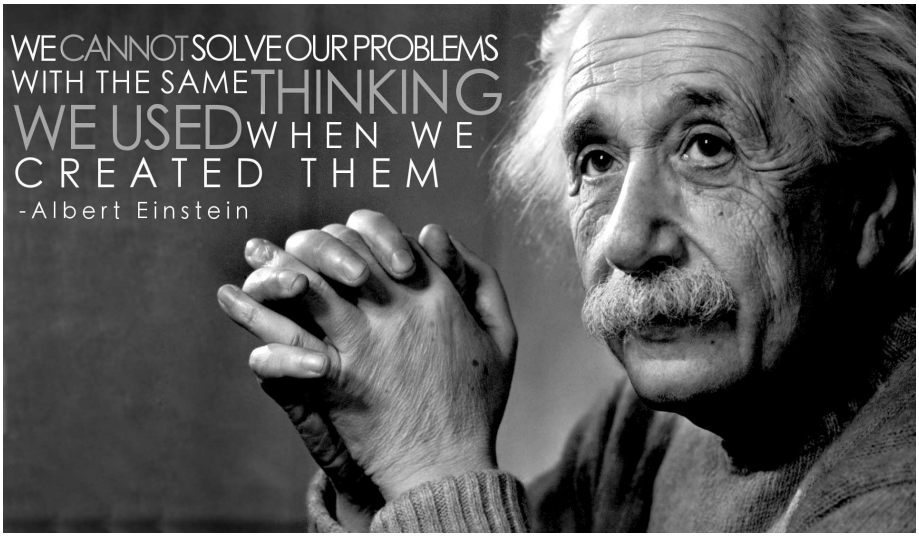
The Argyris-Einstein Link

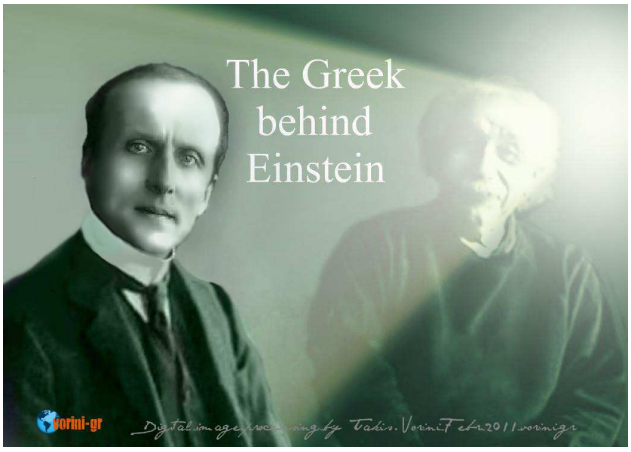
As we enter a New Year, why is it that the UK has lost its way economically since we created the first Industrial Revolution that propelled our nation into the most powerful economic country in the World?

In determining this decline we have to ask the question, what have the two men below got in common with the third person? One is the greatest scientist of the 20th century Albert Einstein, the other debatably the greatest mathematician of the 20th century Constantin Carathéodory (or stated as Konstantinos Karatheodoris by some) and the third person John Argyris, the late founding chairman of the World Innovation Foundation and cited by the USA's greatest ever structural engineer Ray Clough as the inventor of the Finite Element Method in his 1960 publication "The Finite Element Method in Plane Stress Analysis".



Einstein – The 1st man

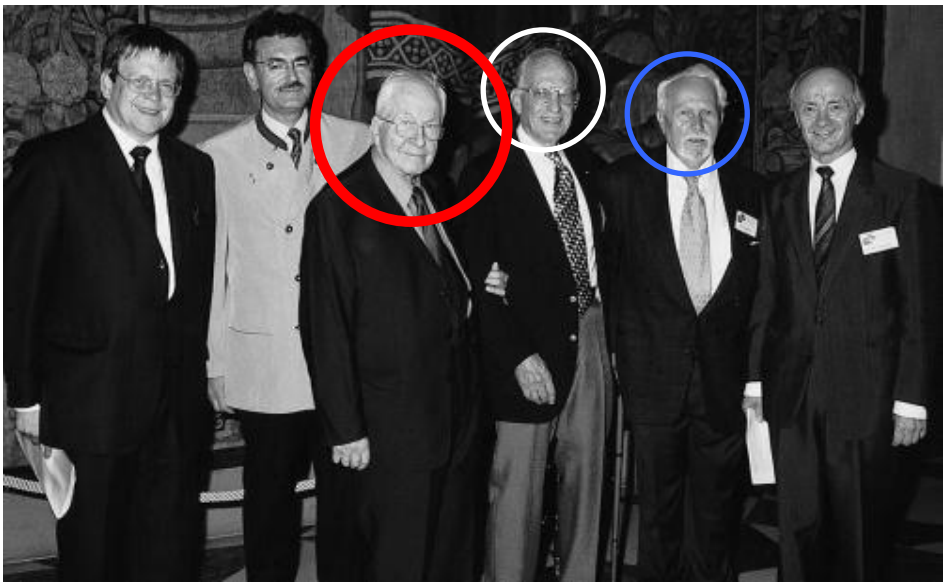
Carathéodory - The 2nd man
& Einstein's Great Mentor'



Carathéodory the great mathematician who gave Einstein the fundamental knowledge for his Great theories in many ways
(http://www.mlahanas.de/Greeks/new/Caratheodory.htm)

The Carathéodory/Einstein's minds combine together to unravel the universe and time itself

Argyris – The 3rd man



Professor John Hadji Argyris at the forefront with FEM world's leading finite element engineers, Professor Ray Clough (white circle) and next to him, Professor Olgierd Zienkiewicz (blue circle)

Introduction

So what has this article to do with Britain's economic decline? In this respect it is an overview of a single engineer whose work has literally transformed the world of engineering but where the UK 'Establishment' does not know or understand the great economic worth and benefit that engineers can bestow upon a nation. This is very clear with the honours system where there are very few engineers that have been knighted over the years and in modern times (not even the greatest Victorian engineer Isambard Kingdom Brunel going back to the dynamic days of the British Empire was made Sir Isambard). Therefore it is clear that the 'Establishment', unlike the Germans who know the great worth of engineers to their economic dynamism, Britain clearly does not. If it did there would countless British engineers who had received a knighthood. Indeed in Germany professional engineers are revered as on the same level as their medical counterpart doctors but not here in the UK for some strange reason, not even when the British Empire was built on the prowess of our engineering skills that was the envy of the world in those times.

Therefore this article concerns how great engineering and scientific genius shapes our world and where because our political and business classes in the United Kingdom have ignored this great strength for years, our economy has sequentially declined. Indeed the complacency of successive governments since the end of WW2 towards the engineering profession within the UK is despicable to say the very least and where it is no wonder that bankers et al have crucified the nation like they have done through the complacency and sheer ignorance of our politicians and Whitehall mandarins. In this respect engineers have been seen by the powers that be as second-class citizens in the wealth creating process and far better to place all the nation's economic eggs in the one basket of the 'City' and service industries than to build a dynamic nation built upon engineering and manufacturing foundations. In this respect again, the whiz kids in Whitehall and the ministers who agreed to concentrate predominantly on the 'City' and service industries, should be hung from Tower Bridge as they were in reality the ones who destroyed our economy and the people's standards of living for decades to come now (that is if we can ever get out of our immense debt and economic problems that these people have taken us too through ignorance?). In

truth government and 'Whitehall' never learn from their mistakes and where in the latter case, they are the greatest threat for this nation to get on its economic feet in the future and in 'real' positive terms, when we exclude the ravages of year-on-year inflation.

The Connection Between Einstein, Carathéodory and Argyris

As previously stated, Professor Ray Clough who has been described by many as the United States of America's greatest ever structural engineer, first coined the phrase The 'Finite Elements Method' in his 1960 publication, "The Finite Element Method in Plane Stress Analysis" at the Proceedings of the 2nd American Society of Civil Engineer's conference on Electronic Computation, Pittsburgh, Philadelphia (1960). In that paper Clough stated that the Finite Element Method was the 'Argyris Method' and therefore ceded the modern day invention of the FEM to Argyris. A man whose name many will not recognise or even know, but where he was an engineering genius just like his uncle had been in advanced mathematics in the early part of the 20th century, and where he was Einstein's mentor, Constantin Carathéodory.

Argyris like his mathematical genius uncle Carathéodory (he was the brother of Argryis's mother) was a civil engineer by qualifications and training, but where they both from this engineering foundation transferred over time to aeronautical and mathematics respectfully. Indeed Carathéodory for a period of time worked for the British in Egypt on dam constructions. Argyris on the other hand worked for a large German civil and structural engineering design company.

But before we really involve Argyris and his work, we have to look at the other two to see whether possibly genius runs in family's blood. In this respect there was no doubt that Einstein and Carathéodory were geniuses but was Argyris also?

The Einstein-Carathéodory Connection

Although there were no doubts that Einstein was a genius as he had brought everything together (in many ways very similar to that of the discovery of the structure of DNA undertaken by Watson), there is quite a bit of evidence that suggests his mathematics were not up to scratch. Some say that his first wife Mileva Marić-Einstein helped him with his polytechnic studies with regard to the mathematics content when they were both at technical university and that she with Carathéodory helped and undertook significant mathematics that underpinned his famous papers. Clues to this are that when Einstein published his first paper his wife's name appeared on the paper as joint-authors/publishers but where after Einstein became world famous, Mileva name disappeared. Einstein even in letters that he did not destroy to Mileva and have been kept for posterity by institutions (for some strange reason Einstein burnt these private letters after the papers on relativity were published), Einstein stated… 'our work'.
The Einstein-Carathéodory letters also reinforce the fact that Einstein's mathematics were supported by the input of Argyris's uncle, Constantin Carathéodory. The following are a few examples of these exchanges and what Einstein said about Carathéodory (and when Einstein was near to the end of his life).

Letter from Einstein to Carathéodory (undated)

Berlin, Sunday

Dear colleague!

I find your derivation wonderful, now I understand everything. At first, the small writing mistakes on the second page had caused me some difficulties. Now, however, I understand everything. You should publish the theory in this new form in the Annals of Physics since the physicists do not normally know anything about this subject as was also the case with me. With my letter I must have come across to you like a Berliner who had just discovered Grunewald and wondered whether people were already living there. If you wouldn't mind also making the effort to present to me the canonical transfromations, you'll find in me a grateful and attentive audience. If you, however, answer the question about the closed time trajectories, I will appear before you with my hands folded. The underlying truth, though, is well worth some perspiration.

Best regards, your Albert Einstein.

Letter from Einstein to Carathéodory
On the 6th of September of 1916 Einstein wrote to Carathéodory and where at the end of his letter, Albert Einstein asked Carathéodory:

"Would you think a little bit about the problem of closed time trajectories? Here lies the essence of this still unsolved part of the space-time problem. I wish you all the best from yours truly, A. Einstein."

(Comment: The above being a great insight and fundamental understanding mathematically into proving the theory of relativity)

Letter from Carathéodory to Einstein
Carathéodory answered to Einstein on December 16, 1916:
"*Dear colleague, the main points in the theory of canonical substitutions can be most easily derived in my opinion in the following way."*
(There then comes mathematical expressions from Hamilton-Jacobi theory. The composition ends ...)
"*With best wishes, yours truly, C. Carathéodory."*

Indeed the few letters that are in existence between Einstein and Carathéodory and visa-versa (the most recent are in the possession of the Israeli authorities) prove Carathéodory was in many ways vital to underpin Einstein's theories (which again some say came from discussions and possibilities with Carathéodory).

Indeed Einstein himself stated during one of his last pubic appearance,

> "You ask me to answer to all sorts of questions, but none has ever wanted to know who was my teacher, who showed me the way to the higher mathematical science, thought and research. I simply say that my teacher was the unrivalled Greek Konstantinos Karatheodoris, to who we owe everything…"

Indeed, it was a Greek from Thrace as he was known where Einstein had been in touch with him and had helped him to complete the theory of relativity in the minds of some eminent mathematician. In this respect the world's mathematical community acknowledged the major offering and contribution of "Kara" , as they name him when it comes to the research of higher mathematics. Indeed Karatheodoris started his studies at the age of 27 and until the last days of his life he kept writing critics and scientific studies. Indeed Karatheodoris's cooperation and communication with Einstein for the theory of relativity is imprinted in the letters they exchanged, which now are exhibited in the museum "Karatheodoris " in Komotini, Greece.

Copies of letters between Einstein and Carathéodory from the period 1916 to 1930 were presented to the Greek officials from Israel's ambassador to Athens a few years ago and reinforces Carathéodory's influence on Einstein's thinking and revolutionary theories.

But on a final note about Einstein's mathematical capabilities, he did not consider that a chain-reaction could happen on earth until a certain Leó Szilárd (who was a student of Einstein) proved to Einstein that it could happen through mathematics and experiment. Thereafter the famous Einstein- Szilárd letter to President Roosevelt that initiated the Manhattan Project to build the 'bomb' before the Germans ultimately succeeded (indeed recent information discovered has shown that the Nazis were not that far away from constructing the 'bomb' and if they had done, Europe, Russia and SE Asia would now be totally under Nazi domination including the UK for probably a thousand Reich years to come as Hitler had predicted). Therefore if Einstein's mathematics were so good why couldn't he work out the mathematical proof that a chain-reaction was possible and where this was left for his student and colleague to determine? As Carathéodory and Argyris had studied, trained and graduated as civil engineers initially and transferred to physics and aeronautics respectfully in later life, it has to be asked is there a fundamental connection in being initially trained as a civil engineer first that gives a fertile ground for mathematics, physics and engineering geniuses to emerge?

In passing, Argyris like his uncle Carathéodory inherited a talent for languages and where Carathéodory's first languages were Greek and French but where also he mastered German with such perfection, that his writings composed in the German language became a stylistic masterwork. Carathéodory also spoke and wrote English, Italian, Turkish, and the ancient languages without any effort. Much more than that, Carathéodory was a treasured conversation partner for his fellow professors in the Munich Department of Philosophy. The well-respected professor for ancient languages Kurt von Fritz praised Carathéodory, saying that from him one could learn an endless amount about the old and new Greece, the old Greek language, and Hellenic mathematics. The philosopher stated that he had an uncountable number of discussions with Carathéodory. He said that deep in his heart, Carathéodory felt himself above anything "Greek" and where the Greek language was exclusively spoken in the Carathéodory's house.

Argyris like his uncle when it came to mastering languages was just like his uncle in this respect and on his large desk in his office within the University of Stuttgart had several phones. One would ring and he would speak in German, then another and he spoke in Russian, then another and he spoke in Japanese and where he was fluent in at least 8 international languages.

The Argyris-Carathéodory Link

As briefly detailed already, Carathéodory was the brother of Argyris's mother and therefore his uncle. Considering that Argyris's mother was made equally of the same stuff as Carathéodory, Argyris's genetic make was in theory half that of the make-up of Carathéodory also. But if this is the case it is strange that geniuses apparently do not see the potential of genius in each other. In this respect when

John Argyris was young his uncle told him that nothing would ever come of him (a very similar situation said about Newton by his contemporaries at Cambridge when he lost his 'groats' after being awarded the lowest BA that the university could award and where he lost his examination deposit – only those who were awarded the lowest degree had their examination fees confiscated and not returned by Cambridge and where this philosophy was seen as an incentive so that students would study hard so that they would not suffer financial lost and the sheer embarrassment that went with being awarded next to failure). But it has to be asked, was this a spur by Carathéodory in the hope that the young Argyris would change or was it sheer arrogance on the part of Carathéodory? One will never know but where certainly Argyris changed the engineering world forever in his later life.

What Argyris Did and His Great Engineering Legacy

The Person – Professor JOHN H. ARGYRIS, DE DSc(Eng) Hon.DSc (Maths), Dr. h.c.mult., FREng (Prince Philip Medal, presented by HRH The Prince Philip), FRS (Royal Medal, presented by HM The Queen), FANAE, FAAAS, FIC, FASCE, Hon.FRAeS, FAIAA, LMNYAS, Hon. FCGI, Hon.MWIF, Hon. Fellow mult., Hon. Professor mult., World Honours mult.

In the year 2000 Professor Dan Givoli, the Lawrence and Marie Feldman Chair in Engineering, Department of Aerospace Engineering, Technion, Israel Institute of Technology, Haifa 32000, Israel stated that it is often claimed that the FEM is the single most important invention in computational engineering. Since the year 2000, the FEM has been acknowledged by many of the world's leading engineers as the greatest invention in mathematical engineering design techniques ever as it solves what used to be unsolvable problems.

Givoli's list in order of pre-eminence was as follows,

1. the Finite Element Method (including the Boundary Element Method);
2. Iterative Linear Algebraic Solvers, include Krylov Spaces, Conjugate Gradient Methods, and GMRES;
3. Algebraic Eigenvalue Solvers, including the Lanczos and QR methods;
4. Matrix Decomposition Methods, including spectral and polar decomposition;
5. Finite Difference Methods for Wave Problems, including the methods of Newmark, Lax-Wendroff, Hilbert-Hughes-Taylor, the shock wave techniques of Godunov, upwinding and flux-splitting;
6. Nonlinear Algebraic Solvers, including Quasi Newton methods such as BFGS, and arclength or continuation methods;
7. the Fast Fourier Transform;
8. Nonlinear Programming, in particular, Quadratic Programming
9. Soft Computing Methods, such as neural networks, genetic algorithms, and fuzzy logic.
10. Multiscale methods, including the multigrid method and wavelets.

Argyris – The WW2 Early Period

Argyris just before the Second World War broke out was working in Germany as an engineer for a large consulting engineering practice working for the Nazis. Indeed the Nazis had been building up their military machine into the world's most powerful throughout the 1930s after coming to power as Hitler had for a long time been putting together a plan for what he intended to do if he became German Chancellor. At that time Argyris was working on all manner of things that previously had been unsolvable and where one was the determination and design of a high mast structure with a very heavy load at the top. These and others were German government projects and where being an accomplished

civil engineer already he was aware at an early stage what the Nazi regime was putting in place. That was through specific military projects and discussions with Nazi military engineers during working relationships on site and through communications. Argyris though loathed the Nazis like a great deal of people in Germany and could see in the early days of Nazism that these engineering works were the precursor for taking Europe and probably the world into another world war. Therefore he decided to try and do something about the situation and help others survive.

In passing and again not known about Argyris, when Jewish friends that he knew were being threatened by the Nazis for deportation to concentration camps he risked his life by getting at least forty young Jewish children and their mothers and fathers through the secrecy of the darkness of night to Sweden by boat (and where then they escaped to London as Sweden was not at that time occupied by the Nazis). Here Argyris risked his life and if the Nazis had discovered this life-saving mission, he would have definitely been shot. Therefore at an early age in his mid-twenties he was a man who cared about humanity and risked his life to save others. How many bankers I would ask would have done that and put their life on the line, but where it has to be said that prior to the financial meltdown our politicians treated these people like demigods in many ways. Indeed it appears even today that situation has not changed in the eyes of the present government as they see no major wrong still in the 'city' and even tried to block the sanctions that the EU is to impose on European financial institutions.

Due to Argyris's knowledge of what was happening inside Nazi Germany and the reasons for these huge civil engineering projects, he tried initially in vain to contact the British government to pass on this vital information that he had at his disposal. No responses from the powers that be in England or through the British Embassy in Berlin were forthcoming. But Argyris did not give up and persisted and where eventually the British started to listen because Argyris warned of the invasion by the Nazis of his homeland Greece. In this respect he had to travel to Greece to do this as the British Embassy in Berlin would not allow him access so the only thing that he could do was to visit the British Embassy in Athens to deliver his knowledge. But as his visa was only for a couple of weeks and because his mother and first wife were still in Germany, he had to return quickly. Argyris when arriving in Athens was allowed a meeting with British Ambassador through his Greek connections and who immediately sent a coded message to London about what the Nazis were intending. Thereafter he travelled back to Berlin but where unknown to Argyris the Nazis were waiting for him at the airport as someone had tipped them off and what he was doing (indeed the Nazis had raided his apartment and had examined his workplace where they found condemning evidence against the Nazi regime).

Argyris was immediately sent to a holding place (small concentration camp) in Germany for deportation to the death camps. Whilst there RAF bombers destroyed part of the security fencing and he and others escaped through the forest. What could Argyris do to save his own life as if he was captured now, he would be summarily executed by the Nazis. He thought long and hard and where his family through their Greek blood knew a certain Admiral Wilhelm (Franz) Canaris, a fellow Greek, who had worked up the military ladder from the First World War to be the head of the German intelligence service, the Abwehr. Canaris was one of the highest ranking officers in the Nazi military machine but where secretly he hated the Nazis also and believed that he could do more good by keeping silent about this and working within this totally detestable regime that was raping Europe and killing millions in the process, than openly speaking out (eventually Canaris was found out and was hanged for high treason on the direct orders of Hitler only a few months before WW2 ended). Indeed Canaris sent the high command all over the place after 1943 when the war was being lost for the Nazis and where when the German military got there, there were no allied troops to fight. These diversions of hundreds of thousands of German troops probably saved tens of thousands of allied lives. Canaris was also one of the high ranking military officers that were directly involved with the assassination of Hitler and for that that was hanged by piano wire, a very slow and painful death. Some say that Canaris was an allied agent for what he had

done during WW2 and where he certainly met British intelligence in Portugal on a few occasions. Added to this his right hand man was honoured after the war by Israel for saving many Jewish people from the gas chambers. Therefore there are many pointers to the probability that Canaris was indeed a spy for the Allies or at the very least, privately supported the Allies and not Hitler's Nazi tyranny.

Therefore Argyris made his way in the night (sleeping during the day for obvious reasons) to Berlin and Canaris. Eventually he met with Admiral Canaris the head of German military intelligence and where Canaris had free-passage papers created for Argyris and signed off by himself (with this in his possession, no-one seeing the signature of Canaris would dare challenge Argyris). But to make perfectly sure Canaris attached his right hand man a certain Captain Dohnanyi to travel with him through Germany to the Swiss border and ultimate freedom.

With the security of Canaris, Argyris and Dohnanyi (who in recent times was awarded Israel's highest honour for saving many Jewish people during the Holocaust years), the Swiss border was reached but where the only obstacle left for his freedom was the River Rhine which Argyris had to swim and did so, even though it was winter at that time and the icy waters were deadly. In this respect people could only last for no more than 10 minutes due to their body shutting down through the intense cold.

Once in Switzerland Argyris was picked up by the Swiss border guards but because he had certain information on him (although completely soddened) including Canaris's pass, over a 3-week period they allowed Argyris to stay. This was early 1941 and where as he was temporarily in limbo in a neutral country where he did not know anyone, but where he was able to communicate with his family and others to let them know that he was safe. They in turn sent Argyris enough money so that he could survive and enrol at the Technical University of Zurich where he completed their two year Doctor of Science higher degree course in engineering in a mere 6-months and was awarded the university's top prize. His engineering brilliance if not previously known to many was clearly shown by this single feat of intellectual excellence; but where unknown to the world-at-large there was much, much more to come from Argyris in future years. Shortly after this achievement, two attempts were made by the Nazis to abduct him back to Germany from Switzerland. In this respects the Nazis through their agents in Switzerland had discovered that Argyris was the very same Argyris that had escaped from them some nine months before and where their spies had even infiltrated the university itself.
Switzerland of course was where Einstein having not been able to secure a life in university research and teaching after graduating obtained employment in Bern as a lowly patent agent to support his young family and himself.

Having being found out by the Nazis he went to the British Embassy to ask for their help. John Argyris told them how he had helped the British with some vital information prior to Greece being invaded through their Greek Embassy in Athens. The embassy contacted Sir Michael Palairet (who had been the Ambassador to Greece at the time that Argyris had given the information) to verify matters and where immediately the British embassy officials were told through a coded message to create some false papers for Argyris and to arrange for his safe passage to England via Spain and then onto Portugal (a neutral country and where if discovered in Franco's fascist Spain over any length of time, Argyris would have been deported back to Nazi Germany (as Franco did not want any trouble with the Nazis and therefore Portugal was a country where Argyris would be safe). Flying from Lisbon to England gave Argyris the greatest of pleasure as he knew that his dream to help Britain in stopping the Nazis was finally at hand. High words these may seem but where these were his ideals from an early adult age.

Argyris – Second World War Effort in England

When Argyris reached Britain at a military air base in England, he was interrogated for three days and nights with little relent by two British military Intelligence officers who could not believe his story of how he had escaped from Germany and the Nazi regime. Indeed initially they believed that he was a German spy as they constantly asked him, ‘how did you hoodwink the Germans for so long?’. Who could blame them for it was quite an extraordinary story. But eventually for Argyris after this continuous and intense interrogation period, British Intelligence was satisfied that John Argyris was genuine and thereafter was attached through Lord Beaverbrook's Ministry of Aircraft Production to the Royal Aeronautical Society (RAeS) who were responsible for giving design instructions to the British Aviation Industry on how to produce high speed fighters, amongst other aircraft designs. Argyris was installed initially as a lowly technical officer, but where due to the RAeS's amazement at his engineering design work that no-one at the Society at that time could follow but was eventually proved to be right, after a mere few months he was promoted to senior technical officer. Indeed, it was agreed and acknowledged at the time that John Argyris was years in advance of any of the other RAeS’s engineers. His knowledge and thinking was, to put it mildly revolutionary in engineering terms. But where this would inevitably be proved to be the case and was the revolutionary thinking behind what would eventually lead to the full creation of the modern 'Finite Element Method’ (the FEM) which was initially conceived and conceptualised in Britain between 1943 and 1945.

When John Argyris's started his work at the RAeS in the early 1943, 'Data-Sheets' for the design of all civil, military bombers and fighter aircraft were issued to the aircraft manufacturing industry by RAeS. However on investigation Argyris found that the design methods and those used by Britain were unsound and where in certain aircraft cases some of these British designs had eighty-percent structural faults within them; a point that some have said after WW2 would have indirectly saved tens of thousands of Allied lives in the future and especially on D-Day through far safer Allied planes. Therefore Argyris who by that time had been made the chief technical officer at the RAeS, set about changing all this and single handily brought all the design data-sheets up to the high standards necessary for the war effort. In this respect British military aircraft were all modified and all new ones constructed to Argyris’s new design data sheets. But all was not fair sailing for Argyris and great difficulties lay ahead as the aircraft establishment (government and Whitehall) were highly negative to change to Argyris’s new revolutionary designs (but where of course they were far safer designs). Their reticence was possible due to being exposed to the British people for ridicule if these facts came out (the Establishment in this regard always try and make the people think that they know best and where they never get it wrong - indeed if the people knew that Allied soldiers et al were being transported in highly unsafe military aircraft, mysterious missing planes would have been explained and where there would have been literally hell on from the backlash from the British people), having custard on their face, embarrassment and sheer fear that the British government had been sending out aircraft that were not technically safe for their military personnel. Indeed, at first they said that what was being asked of them in Whitehall was 'impossible' and could not possibly be right. But where through perseverance and the intervention of the British aircraft manufacturing industry itself and their engineers who backed Argyris’s assessment, the Establishment had to agree that Argyris was right. Indeed through perseverance, tenacity and sheer grit he kept to his engineering convictions that eventually assured that Britain would have through Argyris’s revolutionary new methods far, far safer allied planes that most probably directly saved tens of thousands if not hundreds of thousands of allied lives. For this single feat alone the British government should have awarded Argyris a knighthood, but as he was not an ‘establishment’ man, that was just not going to happen. Indeed, even though he had carried the torch during the later part of the war years in the aviation industry for revolutionary change. For if Argyris had not done this, Britain would have been at a distinct disadvantage in the air, particularly with D-Day looming. In this respect it has to be asked, how many allied troops would have been killed through faulty allied aircraft and not Nazi shells and bullets? For we now know through military historians that the

success of D-Day was on a knife’s edge and finely balanced to go either way and where the massive onslaught and might of the Nazi military machine was eventually brought to bear around Carne. In this respect if not enough allied paratroopers had survived behind enemy lines to prevent the Nazi’s reinforcing more quickly after D-Day, the successful military result of D-Day may have been totally different. That is another reason why Argyris’s work was so very important and why the ‘Establishment’ should have knighted him after the end of WW2. But, this was not to be for the man who saved indirectly tens of thousands of lives as a minimum consideration.

Over a period of time, eminent people within science and engineering acknowledged Argyris's supremacy in aeronautical engineering design and notably a very talented scientist who was the senior principal officer at the National Physical Laboratory (NPL) in Teddington and chairman of the Aeronautical Research Council, a certain Mr. Harold Leslie Cox.

After the war others had seen and could see John Argyris's greatness emerging. Sir Arnold Hall who was senior professor of aeronautical structures at Imperial College, University of London asked him to become senior lecturer and then reader within a couple of months of his initial appointment. Sir Arnold had seen at first hand with amazement the revolutionary things that Argyris had done whilst he was working in the aeronautics industry during the Second World War. Indeed at Imperial College he developed fully his basic thinking on the 'Finite Element Method', the most advanced mathematical engineering design tool in the world today. In this respect one has to say at this point and as the future will most probably tell, like Newton and Leibniz did with the invention of the 'Calculus', Argyris’s FEM will eventually become the engineering equivalent of the Calculus and where many engineers have made this comment already.

Argyris had many first within the aeronautical industry and just one of them was that he was the first engineer ever to design safely the swept-back wings for fighter jets that allowed eventually high-mach speeds possible and again whilst working for the British government. Still Argyris did not get a knighthood from the ‘Establishment’ even though he had made the UK’s defence systems far stronger through having far superior and faster jet fighter planes.

Argyris was made a member of the Aeronautics sub-committee of the Aeronautical Research Council and further advanced their calculations methods and designs. One use of John Argyris's FEM was to determine that the first commercial jet air-liner, the ‘Comet’, was unsafe. He predicted that the plane would crash in its present design form. The Establishment of the time in the shape of the Ministry of Aircraft Production (Ministry of Supply) were outraged and said Argyris's was trying to destroy Britain’s global aircraft industry. Indeed, they said that he was 'mad'. But in support of Argyris, Sir Arnold Hall told the Ministry to be very careful as Argyris knew what he was talking about. Indeed, after the second disintegration of a scheduled Comet flight, an American institution approached Argyris with a view that he would become their primary expert witness and adviser in a class-action in the USA and high court compensation case in the UK through the courts for their clients (relatives of the dead). The prosecution lawyers and relatives stated that they were going to make a formal legal attack on the British aircraft industry. Argyris refused, despite being offered 5 million German Deutsche Marks by the institution. At that time a huge fortune, but where he could not do this to Britain because Britain had saved his life in the war years. A man therefore working for ones adopted country and where this was of more paramount importance than financial reward. But would other people today have done a similar thing such as our illustrious bankers who have brought the West to its economic knees in many ways and have been ennobled and awarded peerages as if they were going out of fashion? Yes therefore we say knowing John that Argyris was a true patriot of his adopted country Britain, and that counted for more than anything else. But still the Establishment would not give him a knighthood or even any national award whatsoever.

But added to this people over history have stated time and time again that knowledge saves lives and where this is perfectly true in the case of Argyris. When the ‘Comet’ was first introduced Argyris and his second wife Ingalisa were passing through Rome airport en-route to the UK and where they were returning from Greece after a holiday. An airport executive spotted Argyris (who was then a world renowned aeronautical engineer that had appeared in aviation magazines all over the world). This airport executive because of the prestige offered to the aircraft industry offered Argyris seats on the ‘Comet’ flying to London. One has to remember that the ‘Comet’ was the equivalent of ‘Concord’ then and everyone wanted to fly on the ‘Comet’, especially the good and the great. He refused and made a scene in Rome airport because he knew of the major structural fault inherent within the ‘Comet’s design. As Argyris and his wife flew back in the standard long-distance turbo-prop propeller plane of the time, and as they were travelling over the Bay of Biscay, they looked down and saw the ‘Comet’ that were offered the VIP seats on in the sea. All passengers and crew perished. That is the power of knowledge and in a dramatic way how it really does saves lives.

As Argyris's great work progressed in bringing the FEM up to an extraordinary level of technical advancement, corporations and government departments around the world would seek Argyris out to solve what seemed to them to be insolvable complex problems. Three of these instances concerned the NASA. The first was the dangers inherent with the design of the mighty Apollo Rockets. This was a tremendous undertaking for which Argyris’s achievements were reported in the American media.

The second was the determination and solving of the landing stabilising technology for the 1969 moon module which was the first moon landing (Armstrong, Aldrin and Collins) and where as with all NASA projects worked on by Argyris, they had to be so that the whole 'Mission' could go and come back 'Safely'. Again Argyris solved the problem which was stopping the launch into space taking place as the unknown was at that time the surface material on the moon and its depth. If the material was too deep and too soft the module would never be able to get off the moon. Therefore the technology and mechanics had to be developed so that the module would take off in any terrain. That was a problem that no-one could solve at the time but Argyris did and the rest is of course history.

And thirdly, the re-entry problem for NASA where the space shuttle could quite easily burn-up when re-entering the earth's atmosphere. The determination of the safety of the nose shield and wing tips were of paramount consideration for NASA. Argyris undertook the mathematical analysis and design of the these two vital elements within the design of the Space Shuttle where the calculations of the high temperatures had to be determined and what their effect would be on the craft’s safety upon re-entry. NASA was greatly impressed as one would be and have ever since used the Finite Element Method as their preeminent engineering design tool to determine their most complex problems.

Adding to this amongst a further multitude of other incredible world-leading engineering feats is the work at the European CERN by Argyris. Indeed, in respect of the NASA work, even other western governments asked Argyris for a copy of his groundbreaking analysis and designs, some of the nations clearly not being able to budget for a manned flight to the moon. Other than governments, the largest corporations in the world such as Daimler Benz, Boeing, Ford, GE and others of similar standing would ask Argyris for his design help. This again usually involved the solution of seemingly insolvable complex problems that they had failed to solve themselves. Indeed Argyris revelled in problems that no-one else could solve, but where time and time again, he did.

But it has to be stated that there were dissenters such as the British ‘Establishment’ of the time in the form of people like Sir Alfred Pugsley who was Director of Aircraft Structures at Farnborough and who was against the work of Argyris. He hindered him at every turn and said that his revolutionary ideas were all nonsense, would never work and cannot be done. But after the ‘Comet’ crash situations, Sir

Alfred even had to accept (although unwillingly) that what Argyris was saying and was doing was 100% correct. This cemented the situation supposingly with the agreement of other high ranking Establishment figures that the FEM was indeed a world-changing revolutionary engineering design tool. But where again Sir Alfred made one overriding comment to Argyris, "Remember that you are here to obey our orders and not to think for yourself"! The bureaucratic Establishment at its best and where we mere mortals are supposed to just serve. Has things really changed though with this 'elitist' mentality it has to be asked and one of the primary reasons to why the UK is in the underlying economic and financial mess that it finds itself today? In this respect according to PwC chief economist in 2009 on far better financial projections, the UK's total debt (everything on-and-off balance sheet) will be £10 Trillion - http://pwc.blogs.com/press_room/2010/11/pwc-projects-total-uk-public-and-private-debt-to-hit-10-trillion-by-2015.html

Argyris continued to develop the potential of the FEM to a remarkable and astonishing extent (and where until his death he advised the world's leading design engineers in the capacity of their mentor, just as his uncle Carathéodory had done with Einstein. The difference this time though was that Argyris was not advising a single person such as the great Einstein, but the whole international community of computational engineers across the globe.

In Germany, in the early 1950s the newly appointed German Federal Minister of Education had heard of Argyris's exploits and his revolutionary work and where he personally travelled to Britain as Germany was building its way back as a nation again after WW2 and where he was so amazed with what he was told when he met Argyris, that he committed Germany straight away to build a world-leading engineering campus around Argyris's extraordinary work. He told Argyris that if he returned to Germany, that all the necessary resources and finance to set up his own institution would be made available. Germany therefore knew the great worth of engineers to a nation's economic building process and where that is just as critical today, if not even more so, than after the Second World War [Unfortunately the British prime minister, politicians and Whitehall just did not understand this and why in many ways the people of the UK will never see their living standards rising in real terms until they get an understanding of what engineers do for a nation's economic wellbeing and where they ultimately deliver economic dynamism to a nation. But the same 'elitist' mentality is apparent even today where politicians and Whitehall never support our engineers and the technologies that they create. Indeed in this respect and as a mere single example of countless that the Establishment has not supported engineers in the UK, the invention of the medical body scanning technology where the global market for these scanners is estimated today to be over US$10 billion a year. Invented over a 17 year period at Aberdeen University by Prof. John Mallard and taken up by a multitude of nations, but not Britain due to political complacency and ignorance].

The German minister told Argyris thereafter to formulate plans for the development of such an institution which he believed was a brilliant concept that would in part lead Germany's new frontier of economic development over time. He was absolutely proven to be right as history can now attest. Britain typically, could not at the time see the immense potential as they did not understand fully the thinking of Argyris, as it was far in advance of anything at the time (but where the 'steady-state' in Whitehall and 'the don't rock the boat' mentality that overrides everything as the government's chief advisers, prevailed as it does today). This concept that the German Federal Minister's intuition perceived is as profound today as it was in the early 1950s and where now over a quarter of a million web sites are either dedicated to the FEM or use its methods continuously. Therefore as the British Establishment would not help Argyris he had no alternative but to leave for Germany with a heavy heart, for he wanted dearly to stay in his adopted country of choice, Britain. But Germany could see where Britain could not and therefore another great loss to the UK's future was sealed again by the 'Establishment' who continuously have no intuition at all, even today of events that could literally change the nation's

economic fortunes. For these and other positive economic issues are the reason why Germany has become the most powerful and dominant economy in Europe today and Britain has continually become a declining economic power. The only blessing was that Argyris continued for a while as professor of Aeronautical Structures at Imperial College after leaving for Stuttgart University, Germany. Indeed, when Argyris was known to be going to Germany, the British Government set up a National Agency for the Finite Element Methods and Standards and where WIF member Professor of Aeronautical Structures at Imperial College Glyn Davies was made a consultant in 1983, the inaugural founding date of the agency by the government. Some in the 'Establishment' therefore realised after the horse had bolted the immense power of Argyris's revolutionary work but where this understanding as usual came far too late to do anything about it. Another classic case of invented here, exploited everywhere else and eventually purchased back by Britain from the nation that saw further than the UK (increasing the balance of payments for Germany in Argyris's case and reducing them for the UK). Sheer madness as usual as all intelligent people know, but where the elitist 'Establishment' appears to have no foresight whatsoever, a total lack of judgement, an perceived idiots understanding of anything engineering, a total loss as too how science can positively revolutionise an economy over time or indeed use any common-sense at all.

The new Argyris institution in Stuttgart, that the German government built for Argyris's work started from nothing but after a short period of time had increased to over thirty highly skilled engineers from England, Europe and the USA. But where this little acorn has now developed since into a massive oak tree that has become the leading institution for computer engineering applications in the world. Its services today are in great demand for solving complex problems and where they are usually before they enter 'Argyris's world', unsolvable to others. Indeed, the Chinese were so amazed with Argyris's work in the early days that they made him like many other nations, an honorary professor of their leading engineering universities.

Therefore with the immense success of the new revolutionary institution, Argyris also started what was to become the world's leading technical journal in Computational Mechanics. He was the Journal's Editor-in-Chief and where it serves the world's leading intuitive engineers (there are over forty publications a year). Conferences for the journal's member are held worldwide annually and include the world's leading mathematicians and engineers. Argyris was their chairman.

Up to his retirement John Argyris took all the institution's doctoral students under his wing and was the final arbiter if they had reached the doctoral level of the world's leading institution in computational mechanics.

Indeed over the years to his death in 2004, Argyris has been honoured by sixteen industrialised nations of the world, many with their highest scientific and engineering honours. Indeed, some have been their Government's highest decorations, but not here in Britain until a minor honour was given in the year 2000.

John Argyris was made CBE in the Queen's Birthday Honours List of 2000 (having UK, Greek and German) but this award for all Argyris's world-changing work and achievements was little more than what he deserved after the Second World War where indirectly by determining up to 80% of structural faults in some of the Allies military aircraft, saved tens of thousands of military personnel as a minimum situation. Indeed, Argyris's Finite Element Method has most probably again indirectly saved many hundreds of thousands of lives if not now going into the millions through safer buildings, dams, trains, cars, buildings, highways and the aeroplanes that we travel in each and every day of the year etc, etc.
Therefore these sheer indirect saving of lives through Argyris's work should have warranted the highest honour that the UK could bestow upon him but where the British 'Establishment' (government and Whitehall) always ignored this great engineer's accomplishments.

The CBE should have been the start, but clearly not the honour worthy of Argyris and his momentous contribution to engineering sciences for Britain and throughout the world. In this respect also the FEM is now being used in most of the other sciences including medicine where for example, it is used to monitor pressures within the human body itself. It appears therefore that the FEM will have no scientific boundaries in the 21st century and beyond, and one thing is certain, it will revolutionise the medical disciplines and all others like it has done for engineering. Indeed, as computers become ever more powerful, the Finite Element Method will truly become to be seen as the equivalent of Newton's Calculus and where infinite computation power will continue to take the FEM to ever greater heights over future decades.

Just before his passing a year before, a Greek journalist wrote an article about Argyris entitled, "The Greek Einstein". This article won the 'all-Greek' journalistic prize and was awarded by the President of Greece. It was a fitting epitaph for probably the greatest engineer of the 20th century and unless something comes along that exceeds Argyris's FEM capabilities, he will most probably be the greatest engineer of this present century as his revolutionary engineering work and legacy continues unabated.

John Argyris is buried in Varberg Cemetery, Sweden. At the ceremony in April of 2004, the Greek government accorded him full recognition sending their consul-general and assistant consul-general to bear his coffin. Both Christian and Greek Orthodox services were conducted sequentially.

The Economic Effects on the UK when Government and Whitehall DO NOT Understand the Great Wealth Creating Propensity of Engineers

There should be no doubt in any intelligent person's mind that a nation cannot increase its 'real' economic wealth without a critical level of engineers being a part of that economic process. The Chinese know this clearly and where there are over 800,000 engineers a year who qualify in all the engineering disciplines. Presently the UK has an abysmal number of engineers compared to the UK's total workforce and that cannot sustain or indeed create a dynamic future for the people of Britain. For without sufficient engineers the country will continue to stagnate and ultimately fail. Unfortunately even after the collapse of the financial system in the West our politicians decided to go down the same old road of ruin and to prop up the banks (who will ultimately most probably fail again with their huge debt that may never be repaid - those elements of our economy that does not really make anything only for themselves, even those banks that are predominantly in state hands through taxpayer's continual bailouts) rather than industry.

Britain has therefore lost its way in the world with the strategy that has come out of government and Whitehall over the last quarter of a century. Indeed we would say again and where as it is highly important to know where it all went wrong for the UK. That can be laid at the feet firmly of those whiz kids in Whitehall and ministers who decided that the nation only required the 'city' and service industries to survive in the 21st century and where they should be strung up under Tower Bridge for Treason. For they are the real villains to why the UK has failed and will continue to do so until a new economic mindset emerges that is based upon long term common-sense. But it has to be stated in this respect though, if new positive change does not come, the 'Establishment' will not be affected as these people are looked after from bureaucratic and political birth until bureaucratic and political grave. It is therefore continually sickening that the people always suffer and who provide all the money for our leaders and senior civil servants to squander time and time again. Indeed sickening also because the 'Establishments' standards of living cannot fail to go up year on year, but where conversely the people's living standards decline year after year, For in this respect official statistics show when taking inflationary pressures into account, that 90% of the people in the UK are getting poorer by the year and the top 10% of people are growing richer by the year. This situation overall is not a good recipe for dynamic economic growth through wealth distribution and is ripe for major civil unrest as the majority

will not stand for this vast wealth disparity indefinitely. Indeed revolutions throughout the history of the world has shown that where considerable social inequality is the case within a nation's people, it is a powder keg waiting to go off one day. Therefore government and Whitehall should be acutely aware of what history has shown in the past.

Considering the above we simply have to make our politicians change the way that they run our economy and where they have for the long-term good of the people of Britain and future generations,

TO MAKE ENGINEERING A PRIORITY OF REBUILDING OUR NATION FOR THE GOOD OF ALL AND NOT JUST FOR THE PRIVILEDGED FEW AS WE HAVE TODAY.

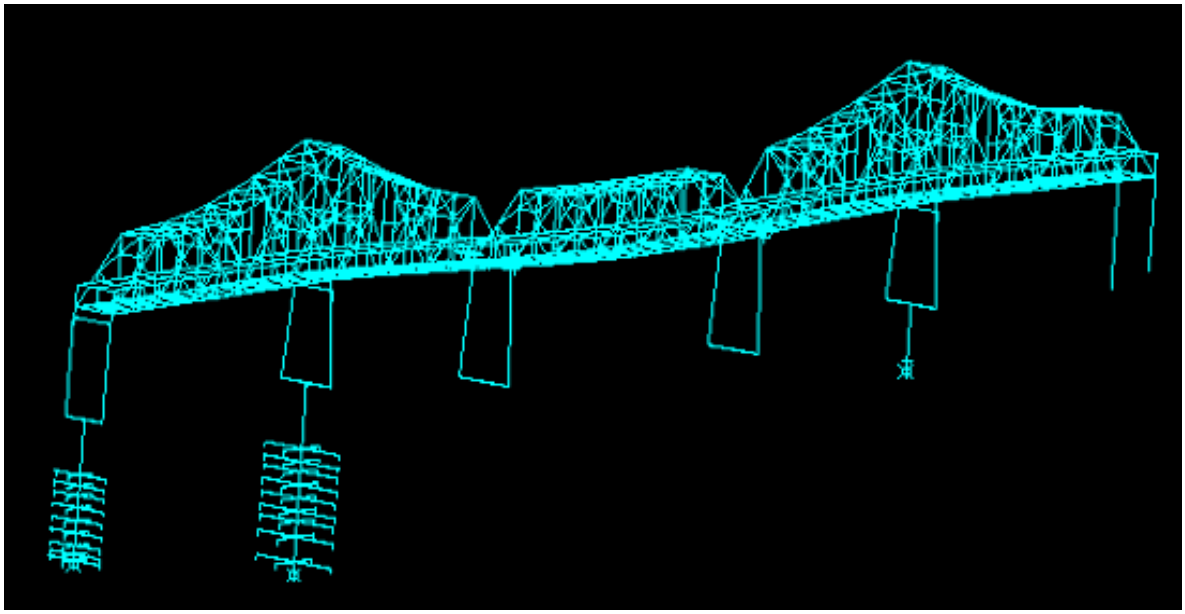
Indeed if we keep with the present thinking our people and future generations will really suffer immensely as the Chinese economy goes into full overdrive during the next 25 years. In this respect now, eastern economies already control over 50% of the world's economic turnover and on its present path will control 75% of the global economic pie by the end of this century. When that happens, the West will only have when we take inflation into account, a mere 25% of the world's economic turnover to feed from and where that means also a drastic reduction in living standards. Therefore we are in a global economic war and where unless we are insane there will not be any more world wars due to the fact of 'Mutually Assured Destruction' (MAD). Considering these facts the wars of the future will be global economic wars and where there is only one economic cake to eat from. Unfortunately economic wars are far more deadly in the long-run to military world wars as they are in perpetuity and are never ending.

In this respect and overall, western governments and western corporations are taking us down by constantly investing in the East and building their economies up at the demise of western economies. Indeed it is short-to-medium term gain over the last 35 years by the West that has powered the Chinese economic phenomena and where this eventually in the long-term will return to bite the West back in a very big way indeed. In this respect as the wealth of the few that has powered this situation has increased astronomically, the people have lost their jobs to the East and their wealth has also declined substantially. Now that China has unprecedented wealth and low debt (less than 11% of GDP) even more jobs and wealth will be lost in the West for the 90% of the people. Has this sacrifice been worth while for the many, we as an institution for one say no.

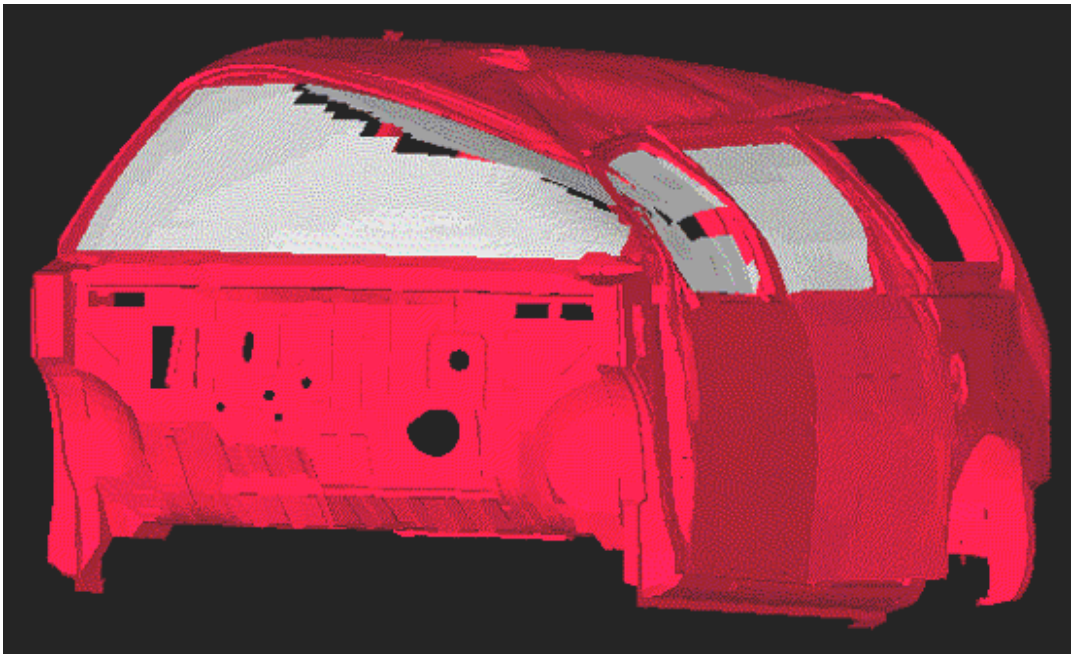
Therefore the Western governments and the UK's 'Establishment' simply cannot see the woods for the trees, but the question is, do they really want to do as they will never want for anything?

Posted on behalf of the Foundation by
Dr David Hill
Chief Executive
World Innovation Foundation
December 2013

Brief Examples of the FEM

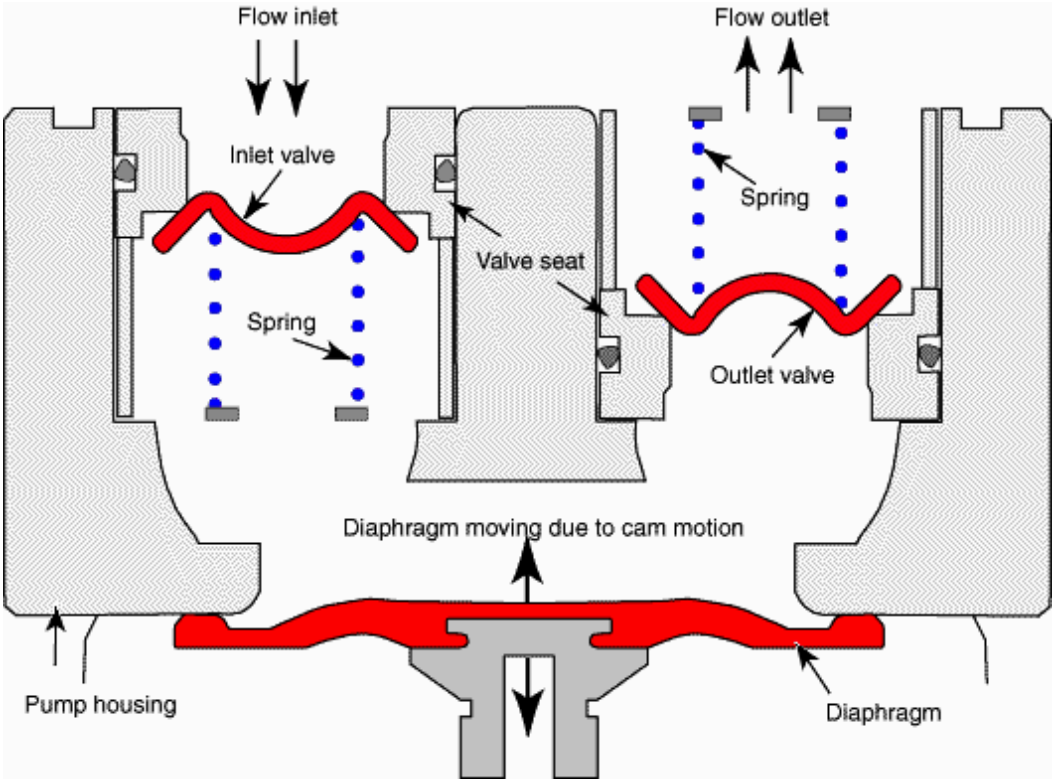


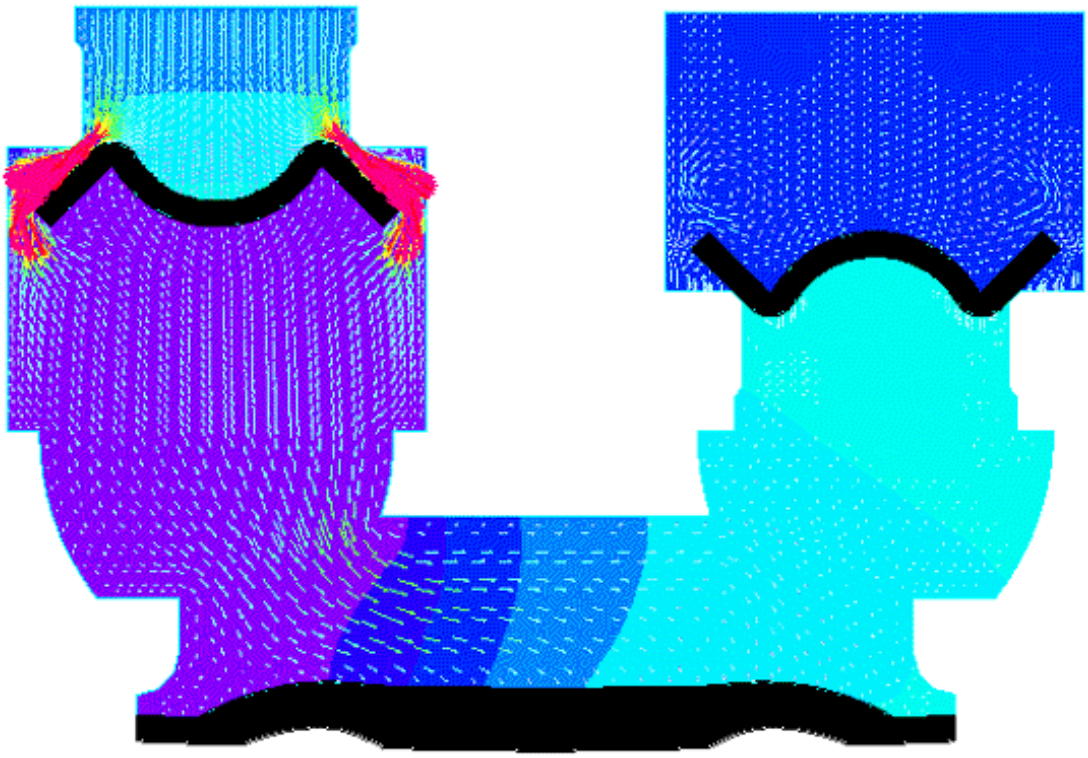
Seismic analysis of San Francisco Oakland Bay Bridge using the Finite Element Method



Crush Analysis of Ford Windstar Motor Vehicle using the Finite Element Method

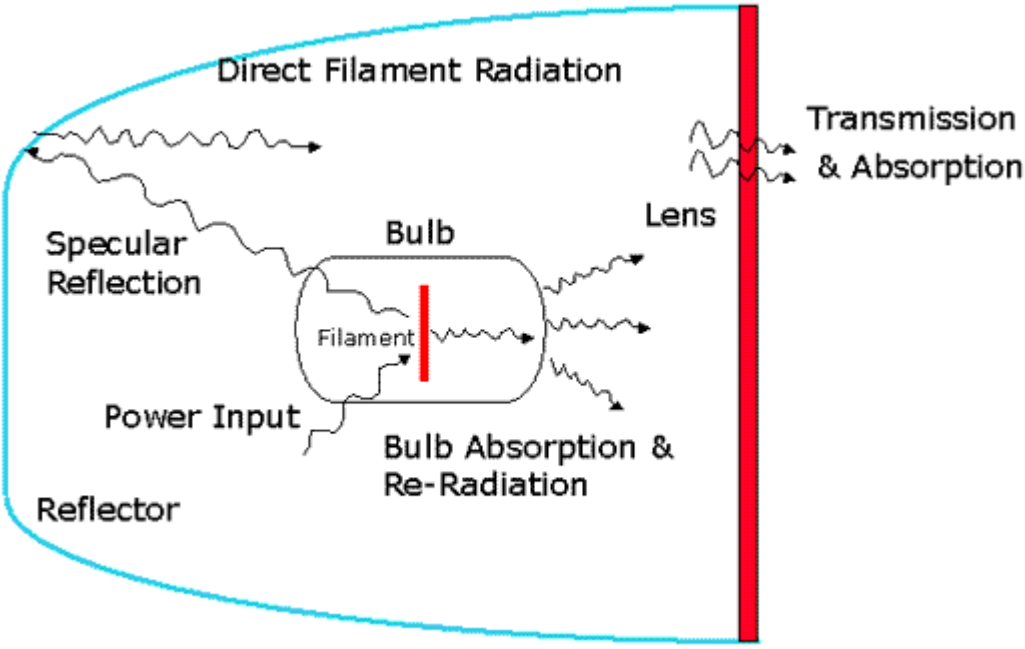
Fluid Structure Interaction (FSI) Analysis of Fuel Pump using the Finite Element Method



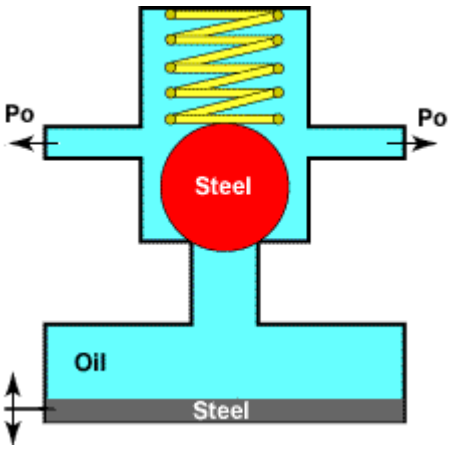


Inlet valve is open; fuel flows into chamber

CFD Thermal Analysis with Specular Radiation of Car Headlamp using the Finite Element Analysis



FSI Analysis (Finite Element Method) of Anti-locking Brake System (ABS)

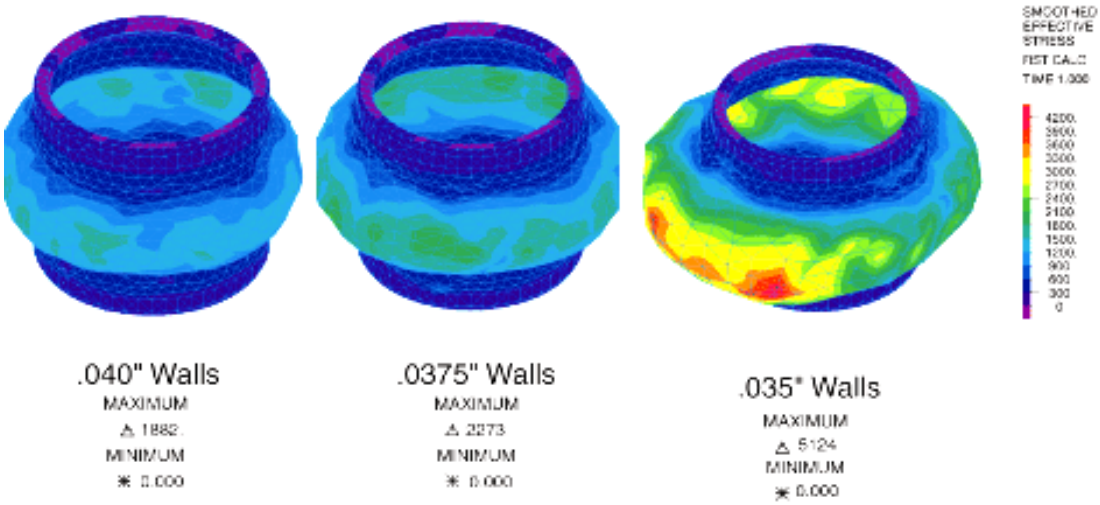


FSI Analysis (Finite Element Method) of Shock Absorber

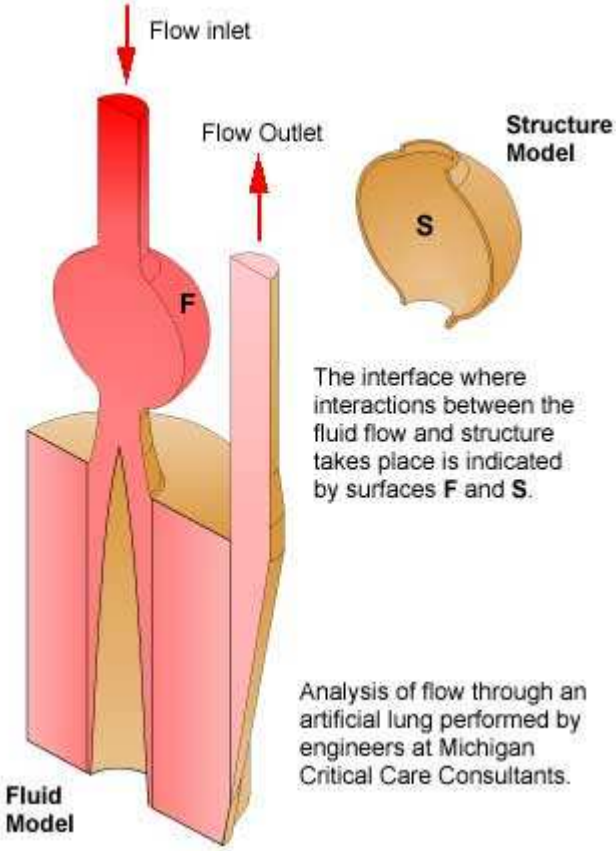
How pressure affects the bladder when wall thickness is reduced from 40 thousandths to

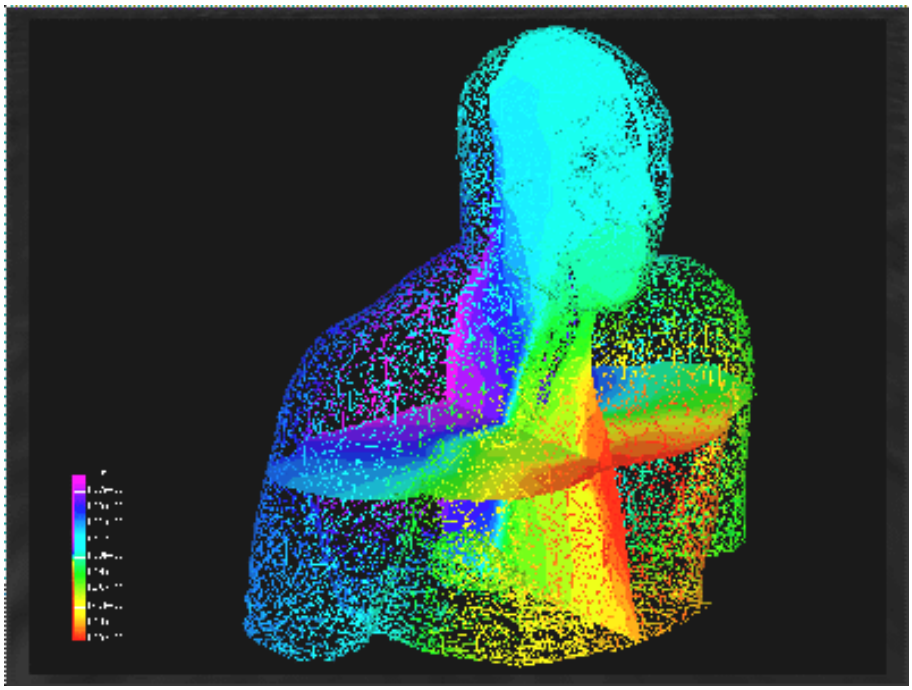
35 thousandths of an inch.

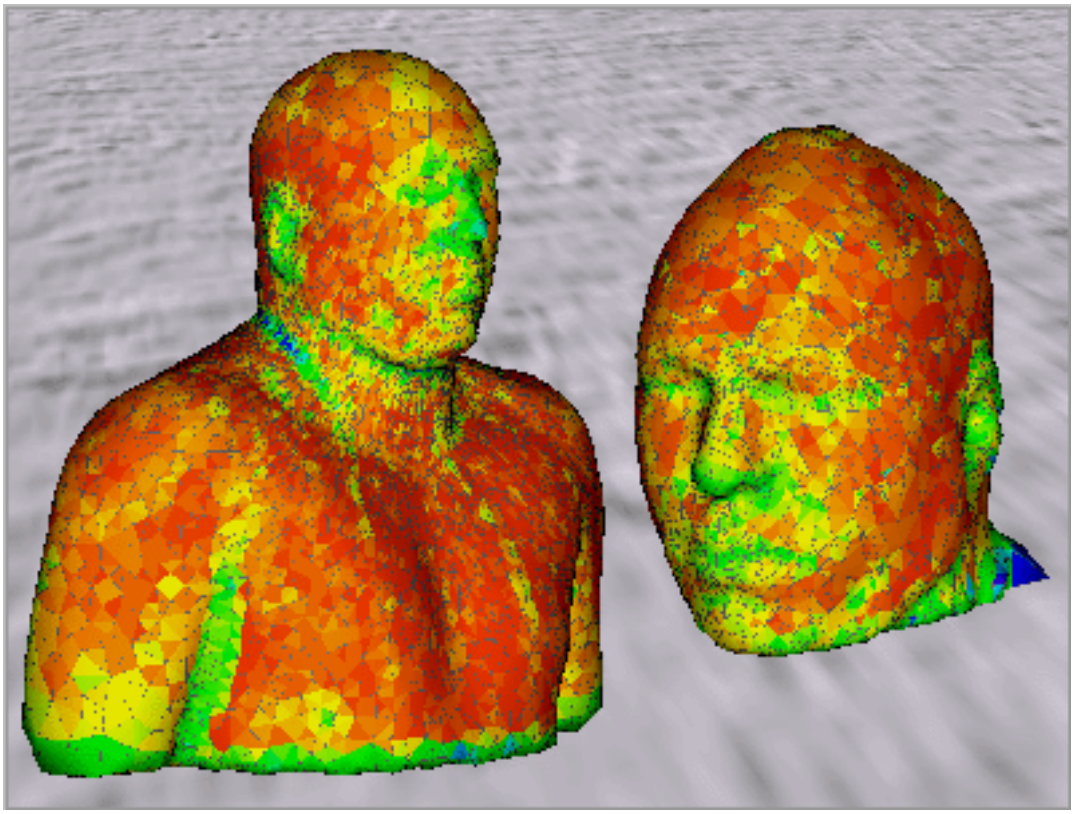
Comparison of the Effects of Equal Pressure on Different Bladder Wall Thicknesses (PSI of Stress)

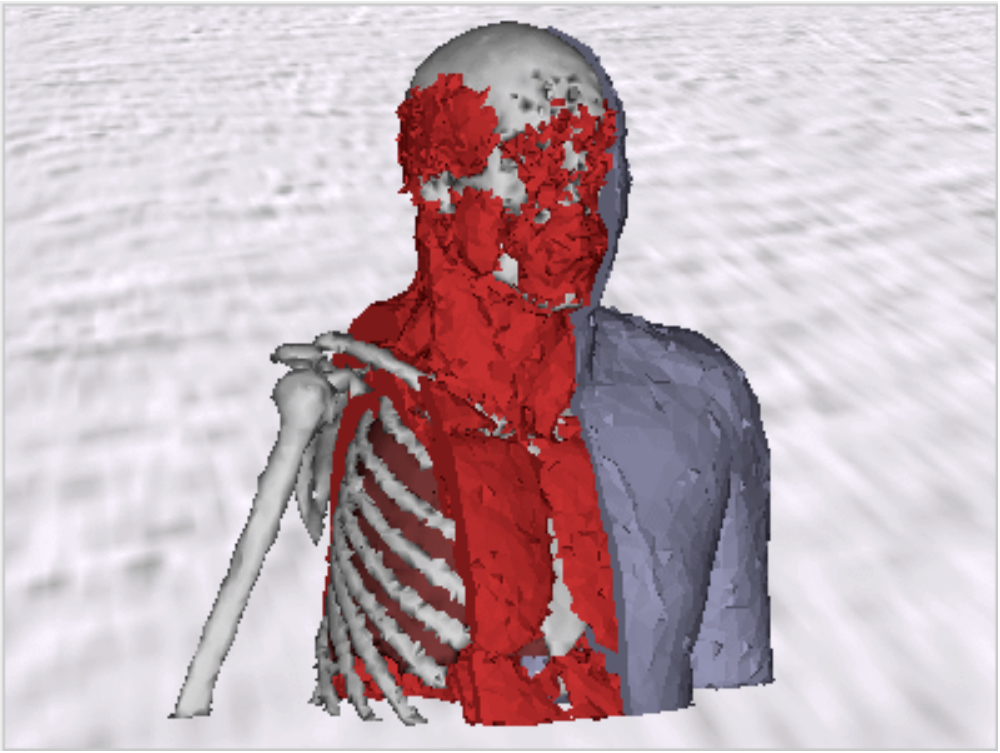


(Finite Element Method) Analysis of Artificial Lung









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Awarded to

Professor John Argyris

FEng FRS

For his outstanding contribution to engineering design through the formulation and development of finite element analysis.

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Philip

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DISTINGUISHED FOR HIS GREAT CONTRIBUTION TO THE DEVELOPMENT OF FINITE ELEMENT ANALYSIS AND ITS APPLICATION TO THE SOLUTION OF ENGINEERING PROBLEMS

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